3152E

Windsor Air Quality Study
L'étude sur la qualité de l'air de Windsor

Windsor Air Quality Committee | Comité sur la qualité de l'air de Windsor

TAGA 6000 Survey Results

REPORTS OF THE WINDSOR AIR QUALITY STUDY

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WINDSOR AIR QUALITY STUDY:

TAGA 6000 SURVEY RESULTS

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WINDSOR AIR QUALITY STUDY:

TAGA 6000 SURVEY RESULTS

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Executive Summary

In 1991 and 1992, the Trace Atmospheric Gas Analyzer (TAGA 6000) units of the Environmental Monitoring and Reporting Branch (formerly Air Resources Branch) performed several mobile air monitoring surveys in the Windsor area. A brief survey was also conducted in 1990. The objective was to measure target gaseous airborne pollutants and apply the TAGA fingerprint technique to determine toxic pollutants not measured by the normal monitoring program. This data can be used to assist in assessing potential health impacts and abatement strategies. The TAGA data is an important source of real-time information, particularly useful for validating theoretical air quality models.

Several air pollutants, selected from a master target list, were measured using the mobile TAGA unit at different areas during the 1991 survey. The Table below lists the areas, potential sources and the target chemicals. Recorded levels never approached current Ministry standards or interim standards; half-hour average concentrations were 2 to 3 orders of magnitude lower.

Area	Potential Sources	Target Chemicals
east Windsor	Ford Casting Plant	dimethylamine, dimethylnitrosamine
east Windsor	Chrysler Minivan Plant	cellosolve, butyl cellosolve, cellosolve acetate
east Windsor	Hiram-Walker Distillery	ethanol, acrylonitrile
downtown Windsor	-	dimethylamine, dimethylnitrosamine, cellosolve, butyl cellosolve, cellosolve acetate, ethanol, acrylonitrile, mercury
west Windsor	-	ethanol, acrylonitrile, dimethylnitrosamine
rural area	-	mercury
east Windsor	Ford Essex Aluminum Plant	styrene, chlorine

The 1992 levels of the target air pollutants at the selected monitoring locations are indicative of typical urban and rural air quality. In general, target pollutants were only detected in the immediate vicinity of the suspected industrial sources. All compounds were either non-detected or detected at low levels. The exceptions were elevated levels of hydrogen fluoride and hydrogen chloride, in excess of Ministry standards, measured downwind of Ford Essex Aluminum Plant. Control measures are currently being put in place to reduce emissions at this facility. The Table below highlights the areas, potential sources and the target chemicals in the 1992 TAGA surveys.

Area	Potential Sources	Target Chemicals
Windsor	general urban and rural areas	ethyl alcohol, acetone, iso-propyl alcohol, ethylene glycol, methyl ethyl ketone, ethyl acetate, methyl iso-butyl ketone, n-butyl acetate, 2-ethyl hexanol, toluene, phenol, xylenes, trimethylbenzenes, naphthalene
Windsor	Detroit incinerator Zalev's Brothers Ford Casting Plant GM Transmission Plant Metro. General Hospital Grace Hospital	mercury
east Windsor	Ford Essex Aluminum Plant	hydrogen fluoride, hydrogen chloride

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1.0 Introduction

As part of the Windsor Air Quality Study, the Mobile Monitoring Group of the Environmental Monitoring and Reporting Branch (formerly Air Resources Branch) conducted several mobile air monitoring surveys in the Windsor area in 1991 and 1992.

1.1 General Description of the Mobile Unit

The host vehicle for the Trace Atmospheric Gas Analyzer (TAGA) instrument is a ten metre Orion coach specially designed as self-contained mobile laboratory for air monitoring. The layout of the mobile laboratory is illustrated in Figure 1.1.1. Equipment in the mobile includes two computer work stations, 17.5 kw generator, meteorological station with retractable tower, fume hood, refrigerator, and communications package. The computer workstations allow direct control of the instrument and data processing. The automatic start feature permits unattended generator power-up of the instrument prior to the monitoring day. A stable temperature is maintained inside the mobile by roof mounted air conditioners or wall mounted electric heaters. Its valuable contents are protected by a halon fire extinguishing system. The meteorological station monitors atmospheric temperature at the roof height and the wind speed and direction at a tower height of ten metres. The fume hood and the refrigerator are used for safe storage of chemical standards. The communication package includes: cellular phone for outside contact, fax machine for data and information transfer, and two-way radio for local communication among survey members in different vehicles.

1.2 The TAGA Chemical Fingerprint Technique

The TAGA 6000 is a tandem mass spectrometer (MS/MS) with an unique air sampling inlet system and ion source (see Figure 1.2.1). No sample preparation is required since ambient air is drawn in at 100 litres/minute from a rooftop inlet directly into the ion source, operating at atmospheric pressure. Ionization of trace contaminants is achieved by chemical ionization (CI) initiated by a corona discharge. Selective ionization of chemical classes is accomplished through the addition of the appropriate CI reagent to the flowing air sample. For example: atmospheric water vapour highlights ketones, aldehydes, alcohols, acids and ethers; oxygen highlights phenols, chlorophenols and acids; benzene highlights aromatic compounds and sulfurous species; and ammonia highlights amines, amides and nitrosamines.

Under atmospheric pressure, ionization of pollutants yields a mixture of parent ions which are sampled through a 100 micrometre orifice into the TAGA vacuum chamber to give a chemical fingerprint of the pollutant. Parent ions are immediately subjected to single MS analysis, and pollutants are identified by MS/MS techniques. Parent ions selected by the first quadrupole (Q1) collide with argon gas in the second quadrupole (Q2, RF only)

undergoing collision-activated dissociation (CAD) to form daughter ions, which are analyzed by the third quadrupole (Q3). The fragmentation pattern, or daughter ion spectrum, is characteristic of the pollutant which produced the parent ion. The resultant daughter ion spectra are then compared to a standard CAD spectrum library for pollutant identification. The sampling and identification routine is achieved in a matter of minutes.

Owing to this system's unique features of direct air sampling and atmospheric chemical ionization, the technique is highly sensitive to many polar organic compounds in real time. In general, the TAGA can detect volatile compounds which contain a heteroatom such as N, O, P, S, or halide. The real-time TAGA detection limits range from 0.01 to 1 micrograms/cubic metre ($\mu g/m^3$), depending on the type of chemical(s) and the complexity of the sample matrix.

Once a compound is identified by the chemical fingerprint technique, data obtained from the daughter ion spectrum can be used to estimate the concentration of the compound. However, each fingerprint requires only a few seconds to complete and thus is a rough estimate, not a half-hour average concentration.

1.3 Quantitation of Target Compounds

The target compounds are selected after determining a representative chemical fingerprint of the pollutants. Quantitation of a target compound is achieved by calibrating the response of the TAGA to known gas phase concentrations of the target compound. Three parent/daughter ion pairs are selected to monitor each target compound. Typically, five-point calibrations are determined at least twice a day: before and after the monitoring period. Calibrations are conducted more frequently in instances where target compound concentrations exceed Ministry standards (Regulation 346), interim standards or Approvals Screening Levels (ASLs). A typical monitoring period is thirty minutes which conforms to the time specified for Ministry standards. With instantaneous measurements acquired by the TAGA every five seconds, a half-hour concentration is the average of 361 consecutive measurements.

1.4 Survey Objectives

The mobile TAGA was used in Windsor to monitor compounds not covered by traditional sampling and analysis methods. The objectives of the TAGA surveys were:

1) to identify ambient air pollutants at each monitoring site by using the TAGA fingerprint technique and to determine levels of toxic pollutants in the airshed which are not monitored by the ambient network;

2) to quantify ambient concentrations of pre-selected air pollutants in downtown, east Windsor, west Windsor, and a rural area fifty km from Windsor;

3) to establish a database of approximate point of impingement concentrations of targeted air pollutants in public areas such as city parks and schools;

4) to determine the ambient concentration of mercury vapour (Hg) at ground level in Windsor using a mercury analyzer installed in the mobile.

1.5 Pre-Windsor Air Quality Study Mobile TAGA Survey

Prior to the start of the Windsor Air Quality Study (June 1991), a mobile air monitoring survey was conducted during the period of July 23 to August 3, 1990. The primary objective of this survey was to determine the ambient ground level concentrations of hydrogen chloride (HCl) and Hg vapour in Windsor downwind of the Greater Detroit Resource Recovery Facility. A secondary objective was to fingerprint the odorous emissions from the Ford Casting Plant in east Windsor. The detailed results of the 1990 survey are presented in Appendix A.

1.5.1 Greater Detroit Resource Recovery Facility

The Greater Detroit Resource Recovery Facility (GDRRF) is located at the NE corner of Russell Street and Ferry Avenue, Detroit, near the intersection of Interstate-75 and Interstate-94. The GDRRF is a municipal waste incinerator capable of handling up to 4000 tons of raw waste each day. The monitoring programme was initiated due to concern over air quality in Windsor, which may be affected by incinerator emissions. Since Windsor is geographically south of Detroit, northerly winds are necessary for monitoring downwind of the GDRRF. Based on meteorological data provided by Air Quality and Meteorology Section of the Environmental Monitoring and Reporting Branch (formerly Air Resources Branch) for the period 1955 to 1980, winds occur most frequently from NNW to NNE during the months of February to April. In general, northerly winds averaged about 5 days per month during these years.

Survey activities were planned according to the daily meteorological conditions, particularly the wind direction. In general the meteorological conditions were not favourable for monitoring the GDRRF. Although GDRRF was monitored on July 25, 31 and most of August 1, only July 31 could be considered truly acceptable for monitoring. During these monitoring periods the incinerator was operating at 60% capacity and visible emissions were not observed from the tall stack.

Since commercial HCl detectors lack the sensitivity for $\mu g/m^3$ detection, a special analytical technique was developed on the TAGA to permit real-time measurements of HCl in the low $\mu g/m^3$ range. Elemental mercury was monitored by a modified Scintrex HGP-2 mercury analyzer housed inside the mobile TAGA.

Twenty-six half-hour average concentrations of HCl were measured along the Detroit River in Windsor. HCl was not detected at a detection limit of approximately 1 $\mu g/m^3$. Thirty-three half-hour average concentrations of Hg, ranging from not detected to 0.042 $\mu g/m^3$, were recorded during this survey. Levels of HCl and Hg, which were monitored simultaneously downwind of GDRRF, showed no correlation.

1.5.2 Ford Casting Plant

The Ford Casting Plant (Ford) is located in east Windsor (enclosed by Cadillac Street, Seminole Street, High Street and Wyandotte Street). This foundry, constructed in the early 1920's, had been renovated and retrofitted after re-opening in 1982. Odorous emissions were the major concern in the vicinity of the plant.

Monitoring in the vicinity of Ford was conducted on July 26, 27, 30 and for a few hours on August 1. Several chemical fingerprints were acquired downwind of Ford while odours were present. Triethylamine and diethylamine were the most abundant compounds. Dimethylamine, acetone, ethylene glycol, methyl ethyl ketone, phenol, aniline, C_2-alkyl benzenes, toluidine, C_3-alkyl benzenes and C_4-alkyl benzenes were also detected. Propanediol, pyridine and methyl furan were tentatively identified (the results from the library search of the daughter ion spectra were not conclusive). Fifty-two half-hour average concentrations of Hg were also recorded in the vicinity of Ford with levels ranging between 0.012 and 0.076 $\mu g/m^3$.

2.0 1991 Mobile TAGA Survey Results

The objective of the 1991 mobile TAGA survey was to quantify ambient concentrations of pre-selected air pollutants at different distances away from the sources. Results obtained in east Windsor in the vicinity of Ford Casting Plant, Chrysler Minivan Plant and Hiram-Walker Distillery are given below. Data obtained in west Windsor and a rural area outside Windsor are also given. Calibrations for the pre-selected air pollutants were performed daily with the TAGA at the West Windsor Water Pollution Control Plant on Ojibway Parkway (Figure 2.0.1). Reference measurements were acquired at the reference site (Figures 2.0.1 and 2.0.2; Site Ref.), the parking lot at the southeast corner of Chatham Street West and Janette Avenue, immediately after the daily calibrations. Reference measurements and calibrations were used to determine detection limits for the target compounds. A separate survey was also conducted in the vicinity of Ford Essex Aluminum Plant.

2.1 Ford Casting Plant

Ford was monitored during August 12 to 14. The objective was to determine ambient levels of dimethylamine (DMA) and dimethylnitrosamine (DMNA) suspected to be present downwind of Ford, and chemically fingerprint odours associated with this foundry. DMA is odorous and DMNA has been listed as a carcinogen by the US EPA. The detection limits ranged between 0.051 and 0.092 $\mu g/m^3$ for DMA and 0.0014 and 0.0045 $\mu g/m^3$ for DMNA. Half-hour average concentrations of these compounds at the reference site were below the detection limits. The monitoring results are summarized in Table 2.1.1. Seventeen half-hour average concentrations of DMA and DMNA were recorded at six different sites downwind of Ford (Figure 2.1.1). DMA was detected during ten half-hour sampling periods at average concentrations ranging from 0.080 to 0.26 $\mu g/m^3$. Instantaneous maximum DMA levels ranged between 0.10 and 0.65 $\mu g/m^3$. DMNA was not detected at any time. An example of the half-hour average of DMA (Table 2.1.1; S12) is shown in Figure 2.1.2. The profile for an ion pair (3 parent/daughter ion pairs were monitored) of this half-hour average is shown along with the profile recorded at the reference site (Table 2.1.1; S14). Decreased DMA levels in the last five minutes were due to wind shift. During this survey foundry odours were noticeable downwind of this casting plant. The minimum odour threshold value for DMA (160 $\mu g/m^3$; Table 6.1.3) is lower than triethylamine (360 $\mu g/m^3$; Table 6.1.3). However, TAGA chemical fingerprints of the odours identified triethylamine as the major compound downwind of Ford. Note that odour thresholds, which are determined for pure compounds, do not account for synergistic effects.

2.2 Chrysler Minivan Plant

Monitoring was conducted during August 26 to 28. The objective was to determine ambient levels of cellosolve, butyl cellosolve and cellosolve acetate downwind of Chrysler

Minivan Plant (Chrysler) and chemically fingerprint odours associated with this plant. Cellosolve and butyl cellosolve are used as solvents for resins and lacquers. Cellosolve acetate is used in automobile lacquers to retard evaporation and impart high gloss. Thus these compounds were expected to be present downwind of Chrysler's painting facility. The detection limits ranged between 0.18 and 0.34 $\mu g/m^3$ for cellosolve, 0.65 and 1.3 $\mu g/m^3$ for butyl cellosolve and 0.55 and 2.2 $\mu g/m^3$ for cellosolve acetate. The monitoring results are summarized in Table 2.2.1. Twenty-one half-hour average concentrations of these compounds were recorded at eleven different sites downwind of Chrysler (Figure 2.2.1). Paint odours were noticeable downwind of the plant. The TAGA's plume tracking capability was utilized on several occasions. A plume tracking response profile for one ion pair of butyl cellosolve is shown in Figure 2.2.2. Levels were elevated near the plant along Chrysler Centre where odours were very noticeable. Lower levels were observed on the next four streets to the east side where odours were faint. Odours were not noticeable at distances greater than about 1 km. An example of butyl cellosolve signals recorded during a half-hour sampling period (Table 2.2.1; S12) is shown in Figure 2.2.3. The appearance and disappearance of the signal coincided with the presence and absence of odours. There were short periods of noticeable odours during this half-hour sampling. Also included in Figure 2.2.3 are the real-time measurements of butyl cellosolve (Table 2.2.1; S11) recorded at the upwind location prior to the downwind monitoring. Cellosolve and butyl cellosolve were detected during sixteen half-hour sampling periods. Half-hour average concentrations were in the 0.38 to 0.86 $\mu g/m^3$ range for cellosolve and 1.0 to 7.3 $\mu g/m^3$ range for butyl cellosolve. Toluene, xylene, acetic acid, methyl iso-butyl ketone, n-butyl acetate, diiso-butyl ketone and butyl carbitol were identified by the TAGA downwind of Chrysler.

2.3 Hiram-Walker Distillery

The Hiram-Walker Distillery (Hiram-Walker) environs were monitored between August 23 and 25. The objective was to determine ambient levels of ethanol and acrylonitrile downwind of Hiram-Walker and chemically fingerprint odours associated with this distillery. The detection limits ranged between 13 and 26 $\mu g/m^3$ for ethanol and 0.26 and 0.45 $\mu g/m^3$ for acrylonitrile. The monitoring results are summarized in Table 2.3.1. Twenty-two half-hour average concentrations were recorded at nine different sites downwind of the distillery (Figure 2.3.1). Ethanol was detected during all twenty-two half-hour sampling periods with average concentrations in the 38 to 1,200 $\mu g/m^3$ range. Instantaneous maximum ethanol levels ranged between 200 to 4,000 $\mu g/m^3$. Acrylonitrile was not detected at any time. Figure 2.3.2 shows the real time measurements of two ion pairs of ethanol recorded during a half-hour period (Table 2.3.1; S19). Rapid changes in ethanol levels are mainly due to air turbulence created by the buildings. The response profiles of two parent/daughter ion pairs obtained downwind of the distillery are similar, indicating the presence of ethanol. Data obtained at the reference site (Table 2.3.1; S09), show that changes in the parent/daughter ion profiles do not correlate, indicating the absence of ethanol. With ENE winds, the real-time plume tracking data for ethanol is shown in Figure 2.3.3. Ethanol was detected between Wyandotte Street East and Cataraqui Street, from Argyle Road to

Marenette Avenue. Alcohol odours were noticeable downwind of this distillery. Ethanol was the only compound identified by the TAGA downwind of Hiram-Walker.

2.4 Downtown Windsor

The survey was conducted on August 21. The objective was to determine ambient levels of DMA, ethanol, acrylonitrile, DMNA, cellosolve, butyl cellosolve, cellosolve acetate and mercury in downtown Windsor. Detection limits for the above chemical compounds were 0.096, 29, 0.64, 0.017, 0.81, 3.3, 2.9 and 0.007 $\mu g/m^3$, respectively. Six half-hour averages were measured beside the Windsor-Essex County (WEC) Health Unit on Erie Street 30 m west of Ouellette Avenue (Figure 2.4.1; Site D1). The monitoring results are summarized in Table 2.4.1. Trace levels of mercury were detected during the first two half-hour sampling periods. None of the other target compounds was detected.

2.5 West Windsor

West Windsor was monitored on August 20, 21 and 28. The main objective was to determine ambient levels of ethanol, acrylonitrile, DMNA and mercury in west Windsor and compare with those obtained in east Windsor. A secondary objective was to monitor air emissions from Zug Island. Detection limits ranged between 19 and 29 $\mu g/m^3$ for ethanol, 0.21 and 0.64 $\mu g/m^3$ for acrylonitrile, and 0.0077 and 0.017 $\mu g/m^3$ for DMNA. The detection limit for mercury was 0.007 $\mu g/m^3$. Mercury was not monitored on August 28. Twenty half-hour average concentrations of ethanol, acrylonitrile, DMNA and mercury were recorded in four different sites in west Windsor (Figure 2.0.1). The monitoring results are summarized in Table 2.5.1. Trace levels of mercury were detected at concentrations ranging between 0.009 and 0.020 $\mu g/m^3$. Ethanol, acrylonitrile and DMNA were not detected. The mobile TAGA was never downwind of Zug Island during this monitoring period and therefore the secondary objective could not be achieved.

2.6 Rural Area

Mercury measurements were taken on August 22 near the Town of Wallaceburg which is approximately 50 km from Windsor (Figure 2.6.1). This data was compared with the ambient concentrations measured in Windsor. The detection limit for mercury was 0.009 $\mu g/m^3$. Eight half-hour averages of mercury were acquired on Baseline Road about 3/4 km north of 4th Concession Gore. This site was approximately 3 km northwest of Wallaceburg. The mercury results and meteorological data are summarized in Table 2.6.1. Mercury levels were similar to those recorded in Windsor (i.e. less than 0.020 $\mu g/m^3$).

2.7 Ford Essex Aluminum Plant

At the request of the Southwestern Region, the Environmental Monitoring and Reporting Branch (formerly Air Resources Branch) conducted an additional mobile air monitoring survey in Windsor, between September 3 and 5, 1991. The primary objectives were to determine the ambient concentrations of styrene and chlorine, as well as fingerprint the odours in the vicinity of Ford Essex Aluminum Plant (Ford Essex).

Ford Essex, an aluminum casting process plant, is located on the west end of Cantelon Drive, east Windsor. During the evaporative casting process, hot melted aluminum is poured into a sand mould, dissolving the styrofoam core, and thus releasing styrene. Chlorine is used as a degassing agent for the molten aluminum.

Odours were the major concern for this survey. However, of the entire survey period, only a couple of hours on September 3 were considered suitable for acquisition of chemical fingerprint data. For the rest of the survey period, odours were only occasionally noticeable. It was extremely difficult to locate points of impingement for styrene and chlorine despite continuous plume tracking downwind of Ford Essex.

Monitoring results and relevant information from this survey are supplied in Appendix B. Table 6.2.1 highlights the compounds detected by the mobile TAGA and their concentrations, **estimated** to within a factor of three. Relatively high levels of hydrogen fluoride and hydrogen chloride were detected at the west end of the parking lot on 2835 Kew Drive (Figure 6.2.1; Site B) prior to a severe thunderstorm. Chlorine, phenol, triethylamine, styrene and butyl carbitol were identified during this survey. (The source of butyl carbitol was probably from a local body shop or the Chrysler Minivan Plant, which is located approximately 4 km west of Ford Essex.) Fifteen half-hour average concentrations of styrene and eight half-hour average concentrations of chlorine (Table 6.2.2) were acquired at the reference site and downwind of Ford Essex (Figure 6.2.1). Intermittent styrene-like odours were noticeable during four sampling periods. All half-hour average concentrations of styrene were lower than the detection limits, which ranged from 0.78 and 4.5 $\mu g/m^3$. Chlorine odours were noticeable only on September 3 at Site B during chemical fingerprinting. The half-hour average concentrations of chlorine were slightly higher than the detection limits, which ranged from 0.28 to 0.44 $\mu g/m^3$.

The acquired data set was insufficient to address the odour problems believed to be caused by styrene and chlorine. However, the high levels of gaseous hydrogen fluoride indicated potential for exceedence of the Ministry standard specified in Regulation 346. As such, a comprehensive survey of the Ford Essex Aluminum Plant was conducted the following survey season.

3.0 1992 Mobile TAGA Survey Results

3.1 Organic Compounds

The 1992 survey focused on establishing concentration profiles of known industrial contaminants in public areas such as city parks and schools. The purpose was to establish a database which could be used by theoretical modellers in determining the impact of air contaminants on the local air quality. The TAGA monitored ethyl alcohol, acetone, iso-propyl alcohol, ethylene glycol, methyl ethyl ketone, ethyl acetate, methyl iso-butyl ketone, n-butyl acetate, 2-ethyl hexanol, toluene, phenol, xylenes, trimethylbenzenes and naphthalene. The selection of these compounds was based primarily on known emission rates from a variety of industrial processes. Known emission contributors included: Canadian Electro Coating, Domestic Foundry Ltd., Ford Engine Plant, General Motors Transmission Plant, McInnis Systems Ltd., Arvid Machine Tools Ltd., Windsor Plastic Products Ltd., Riverside Fabrications, Fabricated Steel Products and Kendan Manufacturing Ltd.

Monitoring was performed in the Windsor area at ten urban and two rural locations (Figure 3.1.1). Their exact locations are summarized in Table 3.1.1. Several hours of monitoring were performed at least once at most locations. Evening monitoring was also performed near the river just west of the Ambassador Bridge (Site 11), and close to Zalev's Brothers (Site 12). Also included in Table 3.1.1 are the monitoring periods of the TAGA fingerprints and the meteorological data. Identification was achieved by comparing the real-time data with the TAGA's spectral library of standards. Accurate quantitation of the fourteen target compounds was not performed during this survey. However, these compounds have been calibrated in past TAGA surveys and their detection limits were of the order of 1 $\mu g/m^3$. The approximate concentrations listed in Table 3.1.2 refer to instantaneous values recorded during general fingerprint scans. Instantaneous levels for the target compounds ranged from 1 to 290 $\mu g/m^3$. Ministry standards, based on the average point of impingement level for 1/2-hour sampling, range from 36 $\mu g/m^3$ for naphthalene to 48,000 $\mu g/m^3$ for acetone (Table 3.1.3). Approximate concentrations never approached Ministry standards and in fact were hundreds of times lower.

A comparison of the monitoring results (Table 3.1.2) showed that levels of air contaminants measured in Windsor (Sites 1-8, 11, 12) were higher than those at the rural locations, Sites 9 (Reference) and 10. It is also important to compare results obtained in west (Sites 1, 2, 11), central (Sites 3, 8, 12) and east Windsor (Sites 4, 5, 6, 7). Such comparisons in conjunction with the meteorological data may yield useful information as to the relative impact of the different industries on the local air quality. Iso-propyl alcohol, 2-ethyl hexanol and naphthalene were not detected during this survey.

Since the 1992 survey dealt with general air quality, TAGA chemical fingerprints were also scanned at each location to screen for compounds other than the target ones. In a few

incidents, compounds other than the target ones (Table 3.1.2) were detected. For example, triethylamine was detected downwind of Ford Casting Plant, butyl cellosolve near Chrysler Minivan Plant and ethyl alcohol close to Hiram-Walker Distillery. As in the 1991 survey, distinguishable odours were evident only in the immediate vicinity of industries; foundry odours near Ford, paint odours near Chrysler and alcohol odours near Hiram-Walker. However, in city parks and public schools located at least one km from industries, odours were never noted.

3.2 Mercury

As part of the Windsor Air Quality Study, the Mobile Monitoring Group conducted a second mobile air monitoring survey in Windsor during October 13 to 30, 1992. The primary objective of this survey was to determine the ambient concentration of mercury vapour at ground level in Windsor. Hg was monitored by a new Model 2537 Mercury Vapour Analyzer which is custom built for the Mobile Monitoring Group. This instrument uses a dual cartridge system for near real-time monitoring. It achieves "high time resolution" through parallel adsorption/desorption-analysis cycles, resulting in readings every 5 minutes. A half-hour average concentration is the average of six 5-minute measurements. The instrument was installed in the second TAGA 6000 bus - the "Explorer".

During the 1990 and 1991 Windsor surveys, Hg had been monitored using a modified Scintrex HGP-2 Mercury Analyzer with a detection limit in the 7 to 12 nanograms/cubic metre (ng/m^3) range. However, the detection limit for the new analyzer is approximately 0.13 ng/m^3, which is at least 50 times better than the older Scintrex instrument. With this enhanced sensitivity, the Hg survey was conducted in 5 targeted areas:

1. Detroit incinerator (downwind in Windsor)
2. Zalev's Brothers
3. Previous potential Hg sites
   - Ford Casting Plant
   - GM Transmission Plant
   - Metropolitan General Hospital
   - Grace Hospital
4. Downwind of Zug Island
5. Background monitoring (rural area)

Fifty-one half-hour average concentrations of Hg were acquired between October 13 and 30. The results and relevant information are summarized in Table 3.2.1. Figure 3.2.1 shows the monitoring sites (A to S). Their exact locations are summarized in Table 3.2.2. Included in Figure 3.2.2 and Table 3.2.1 are the fifty-one half-hour averages and their corresponding highest 5-minute measurements. The Ministry standard for the half-hour point of impingement limit of Hg is 5,000 ng/m^3, based on health effects.

Only two out of the eight monitoring days (October 21 and 29) were suitable for tracking the Detroit incinerator and the Zug Island plumes. The twelve half-hour averages of Hg (S28-31, S42-49) recorded downwind of Detroit, ranged between 2.1 and 6.6 ng/m^3. The highest 5-minute measurement during this period was 17 ng/m^3 (S45). Reference ambient Hg levels (S32, S50-51) measured outside the Detroit plume in the rural area ranged from 1.2 and 1.4 ng/m^3. However, the lack of ideal meteorological conditions restricted any monitoring downwind of Zug Island.

Three half-hour averages of Hg (S01, S03, S14) measured downwind of General Motors Transmission Plant ranged between 3.2 and 7.0 ng/m^3. Five half-hour averages (S16, S24-27), ranging between 3.2 and 8.7 ng/m^3, were recorded downwind of the Ford Casting Plant. Six half-hour averages (S33-38) downwind of the Metropolitan General Hospital and the Grace Hospital during incineration operations, showed levels between 1.4 and 2.4 ng/m^3, comparable to the reference levels measured in the rural area.

While monitoring downwind of General Motors, a Hg "hot spot" was identified in the vicinity of Dominion Forge - an abandoned building located at the corner of Seminole Street and St. Luke Street. Nine half-hour averages (S02, S04, S11-13, S20-24), ranging between 15 and 130 ng/m^3, were acquired downwind of Dominion Forge. The highest 5-minute measurement was 210 ng/m^3.

3.3 Hydrogen Fluoride and Hydrogen Chloride

This was a follow-up survey on Ford Essex Aluminum Plant. During the 1991 survey, poor weather conditions limited the monitoring to only three days. Quantitation was performed only for styrene and chlorine at that time. However, the acquired data set was insufficient to address the odour problems believed to be caused by styrene and chlorine. Although HF was detected at levels which were estimated to be over the Ministry standard, accurate quantitation could not be determined at that time. This survey was conducted in order to examine more accurately the odours from Ford Essex and quantitate HF and HCl levels.

Monitoring results and relevant information from the 1992 survey are supplied in Appendix C. Major contaminants identified by the TAGA fingerprint technique downwind of Ford Essex were HF, HCl and styrene. Traces (a few μg/m^3) of aniline, phenol and triethylamine were also detected (Table 6.3.1).

During this survey, half-hour average concentrations for HF and HCl were determined daily by calibrating the response of the TAGA for each of these compounds. The detection limits ranged from 0.97 to 1.8 μg/m^3 for HF and 1.1 to 5.5 μg/m^3 for HCl.

Fifty-four half-hour average concentrations of HF were determined at 18 different sites downwind of Ford Essex. An example of a half-hour real-time measurement of HF is

given in Figure 6.3.2. The results for HF and relevant information are summarized in Table 6.3.2. The Ministry standard for HF, based on a half-hour monitoring period, is 4.3 $\mu g/m^3$ during the growing season (April 15 to October 15). Of the 54 half-hour averages for HF, 48 or 89%, were above 4.3 $\mu g/m^3$ and 20 of these were at least 10 times higher than the Ministry standard. The half-hour average concentrations of HF determined in this survey ranged from "not detected" (less than 1 $\mu g/m^3$) to 190 $\mu g/m^3$ (Figure 6.3.3).

Fifty-three half-hour averages of HCl were recorded concurrently with HF measurements. The results for HCl and relevant information are also included in Table 6.3.2. The Ministry standard for HCl is 100 $\mu g/m^3$. Of the 53 half-hour averages for HCl, 17 were above 100 $\mu g/m^3$. Ten half-hour averages were at least 2 times higher than the Ministry standard. The half-hour average concentrations of HCl determined in this survey ranged from "not detected" (less than 1 $\mu g/m^3$) to 490 $\mu g/m^3$ (Figure 6.3.4).

HF and HCl levels exceeded the Ministry standards on many occasions during this survey. During strong odour episodes, instantaneous levels for HF and HCl were considerably higher than the half-hour average concentrations. As shown in Figure 6.3.2, the half-hour average (Table 6.3.2; S46) for HF is 32 $\mu g/m^3$ which is about 7 times higher than the Ministry standard. For the same sample, the half-hour average for HCl was 55 $\mu g/m^3$ which is about 2 times lower than the Ministry standard. However, there were several separate incidents in which the instantaneous levels were much higher with a maximum recorded level of nearly 180 $\mu g/m^3$ for HF and 550 $\mu g/m^3$ for HCl. Instantaneous increases in levels during the half-hour sampling periods coincided with burning odours. When odours were rubbery, or styrene-like, the levels of HF and HCl were lower. Published minimum odour threshold values for HF and HCl are 30 and 380 $\mu g/m^3$, respectively (Table 6.3.1). These values were exceeded numerous times during most of the half-hour sampling periods.

Odours were apparent on several occasions while monitoring in the vicinity of Ford Essex. Two types of odour were noted: burning and rubbery. These probably originated from two separate sources from the casting plant corresponding to a source of HF and HCl and a source of styrene. A few times during the survey, emissions from Ford Essex formed a wide, dense plume which was visible for several km downwind. Plume tracking for HF and HCl was performed by driving the mobile TAGA around Ford Essex, particularly in the residential area to the west. A plume tracking result for HF is shown in Figure 6.3.5. With the wind originating from ENE, the mobile TAGA slowly traversed the streets west of Ford Essex to Pillette Road, between Queen Elizabeth Drive and Rose Avenue (Figure 6.3.6). Elevation in HF and HCl levels was observed between Grand Boulevard and Haig Street (A,C,E,F,H,J,L) i.e., directly downwind of Ford Essex. Burning-type odours coincided with the observed increases in HF and HCl levels. Strong odours were noticed as far as Clemenceau Blvd, diminishing as the TAGA moved west. HF and HCl were detected as far as 2 km from Ford Essex.

4.0 Summary

Table 4.0.1 summarizes the maximum half-hour average concentrations of the target compounds recorded downwind of the selected emission sources during the 1991 survey. For comparison purposes, available Ministry standards are listed. It is important to note that none of the eight chemicals (dimethylamine, ethanol, acrylonitrile, dimethylnitrosamine, cellosolve, butyl cellosolve, cellosolve acetate, and mercury) which were monitored ever approached Ministry standards; half-hour average concentrations were 2 to 3 orders of magnitude lower. However, HF and HCl were not quantified in 1991.

The 1992 TAGA survey results indicate that levels of the target compounds at the selected monitoring locations are mainly indicative of urban and rural air quality, with the exception of Ford Essex. Note that the TAGA is particularly effective for pinpointing emission sources. This was demonstrated during the Windsor 1991 surveys by profiling plumes of specific sources. It was shown in Figures 2.2.2 and 2.3.3 that concentrations of air contaminants drop off rapidly with distance from a source. The 1992 survey dealt with emissions from many sources; thus monitoring was performed in open areas at least one km from any known source so low levels of air contaminants were expected. Indeed, the fourteen target compounds were detected at low levels or non-detected indicating, once again, that air contaminants are localized in the immediate vicinity of the various Windsor industries.

With the enhanced sensitivity of the new Hg analyzer, a total of fifty-one half-hour average concentrations of Hg, ranging between 1.2 and 130 ng/m^3 were acquired during the 1992 survey. All half-hour averages were below the Ministry standard. Although a half-hour average of 160 ng/m^3 was recorded downwind of the Ford Casting Plant in 1990, such levels were not observed during this survey. Measurements ranged between 3.2 and 8.7 ng/m^3. Long-term monitoring may be necessary to account for this variation. Half-hour averages recorded downwind of GM Transmission Plant and Zalev's Brothers ranged between 2.4 and 13 ng/m^3. Hg measurements downwind of Grace Hospital and Metropolitan Hospital during incinerator operations were comparable to the rural area measurements. Elevated levels of Hg were recorded downwind of a non-targeted source (Dominion Forge), with the highest half-hour average of 130 ng/m^3. The lack of northerly winds restricted attempts to establish a database of Hg measurements in Windsor downwind of Detroit. Only twelve half-hour averages were measured downwind of Detroit in Windsor. Since the Detroit incinerator is approximately 5 km from Windsor, these limited measurements cannot be used to differentiate the incinerator plume from the other sources. Differentiation of the Detroit plumes may be accomplished by conducting a survey in the Detroit area.

Odorous air contaminants were present in the vicinity of Ford Essex Aluminum Plant during the 1992 survey. Many of the half-hour averages for HF and HCl exceeded the levels permitted by Regulation 346. The maximum half-hour average concentration for HF was 190 μg/m^3 and that for HCl, 490 μg/m^3. For brief periods when odours were strong, instantaneous levels of HF and HCl were considerably higher. In winter 1992, Ford proposed possible modifications to operation to reduce HF and HCl emissions, and further emissions controls were planned. The company is currently installing control equipment to reduce HF and HCl emissions to the atmosphere. A TAGA survey will be conducted after the modifications are completed.

5.0 Acknowledgements

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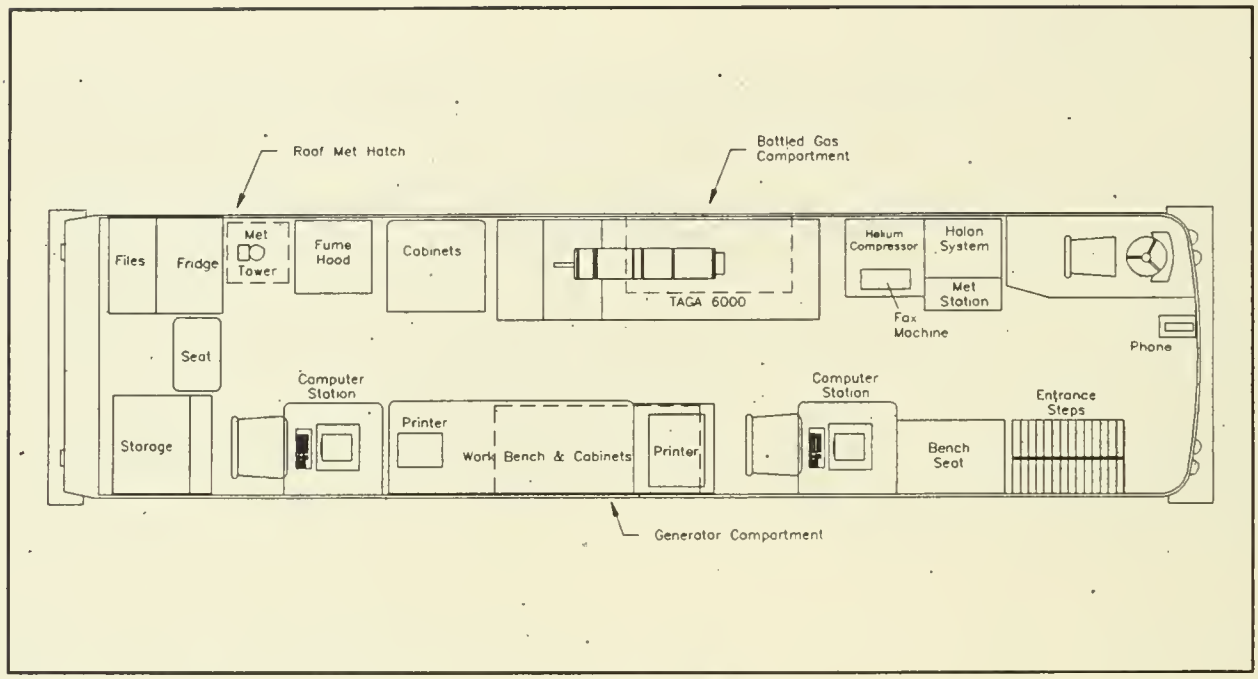

Figure 1.1.1: TAGA 6000 mobile laboratory floor plan.

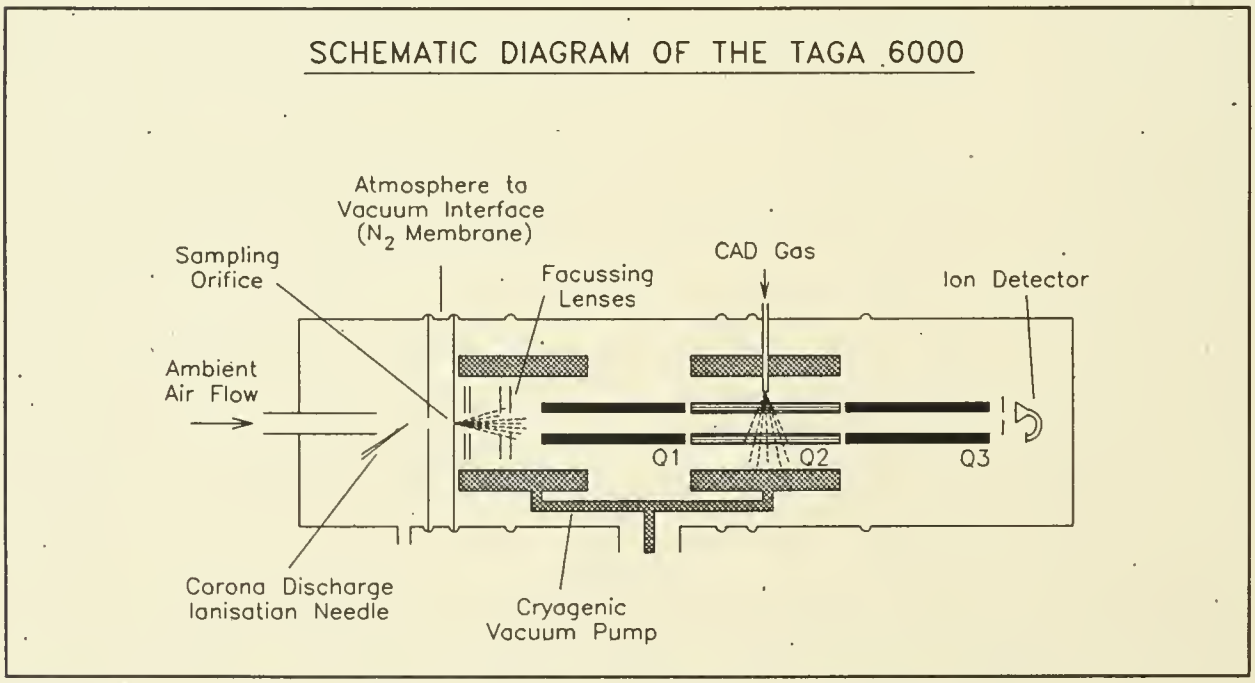

Figure 1.2.1: Schematic diagram of the TAGA 6000 APCI/MS/MS system.

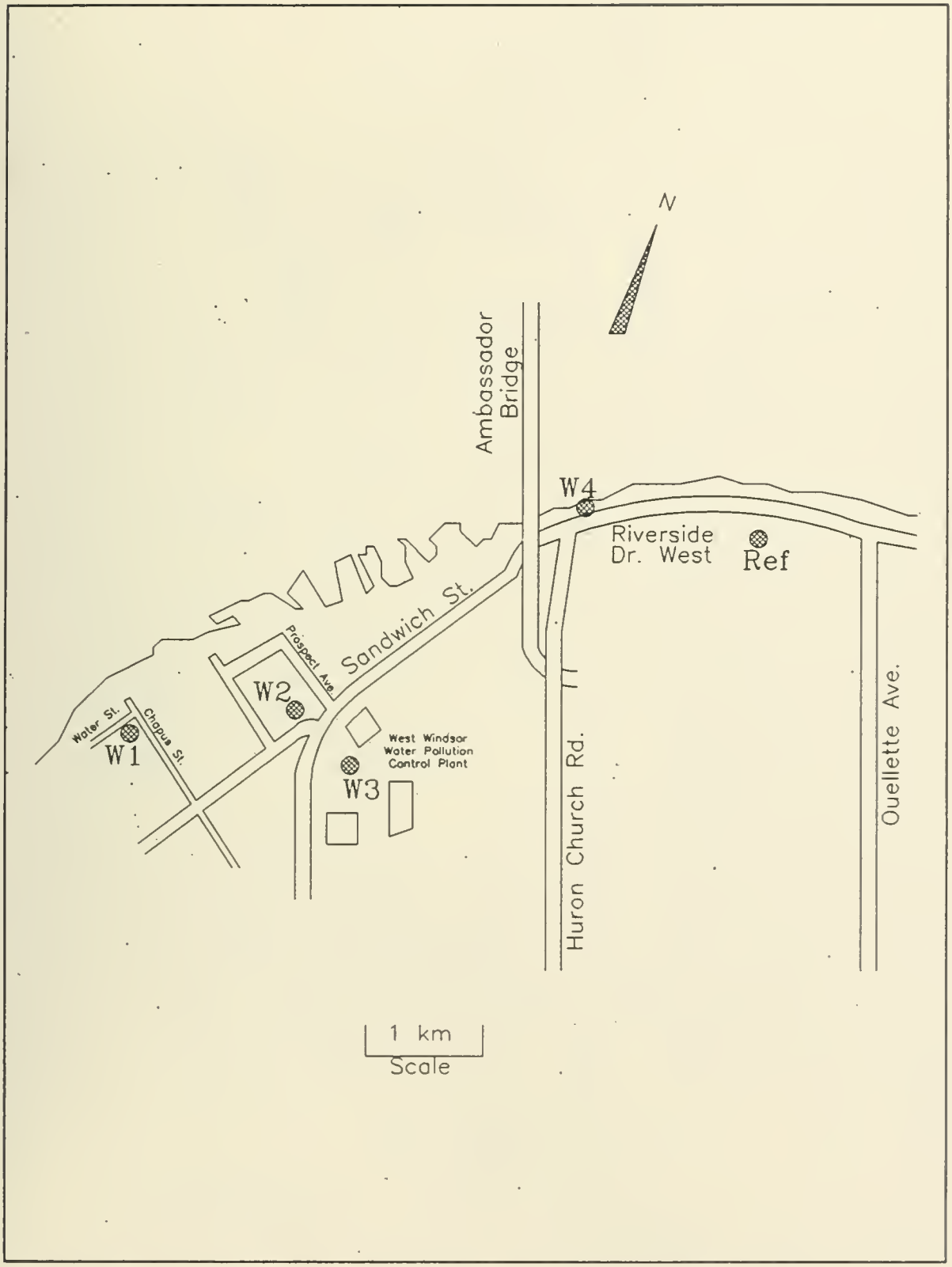

Figure 2.0.1: TAGA 6000 monitoring sites in west Windsor, August 1991.

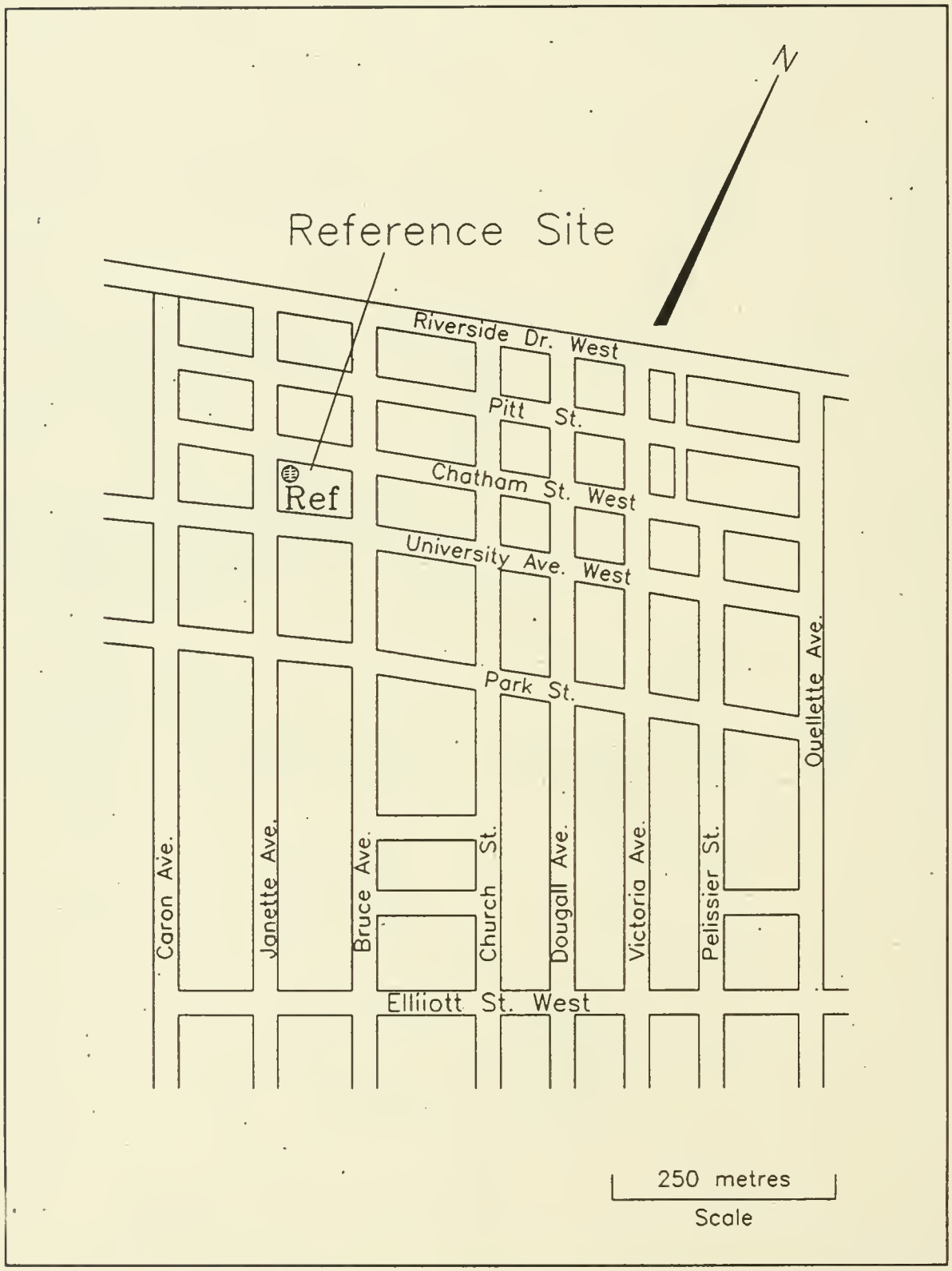

Figure 2.0.2: TAGA 6000 reference monitoring site in Windsor, August 1991.

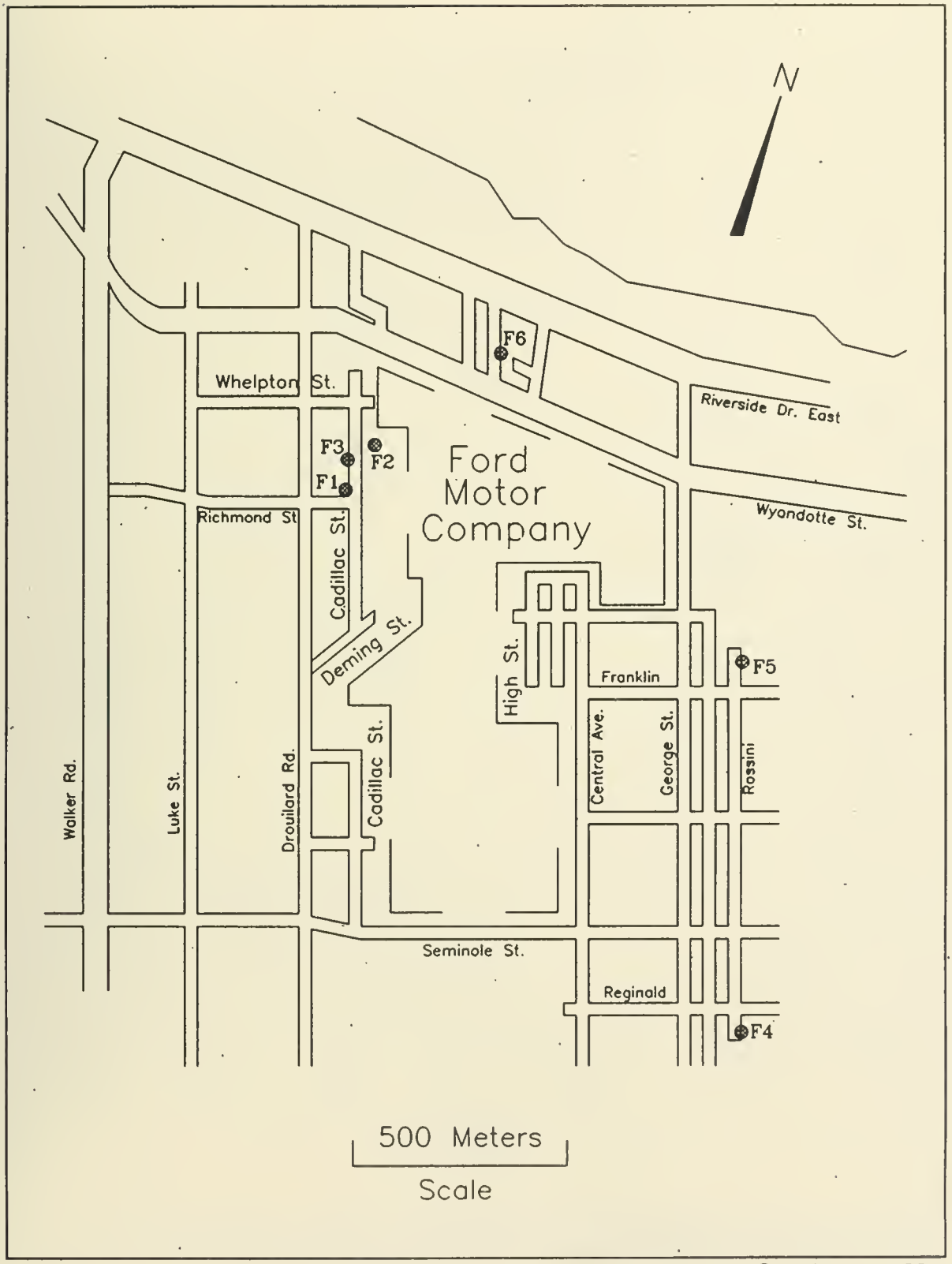

Figure 2.1.1: TAGA 6000 monitoring sites downwind of Ford Motor Co., August 1991.

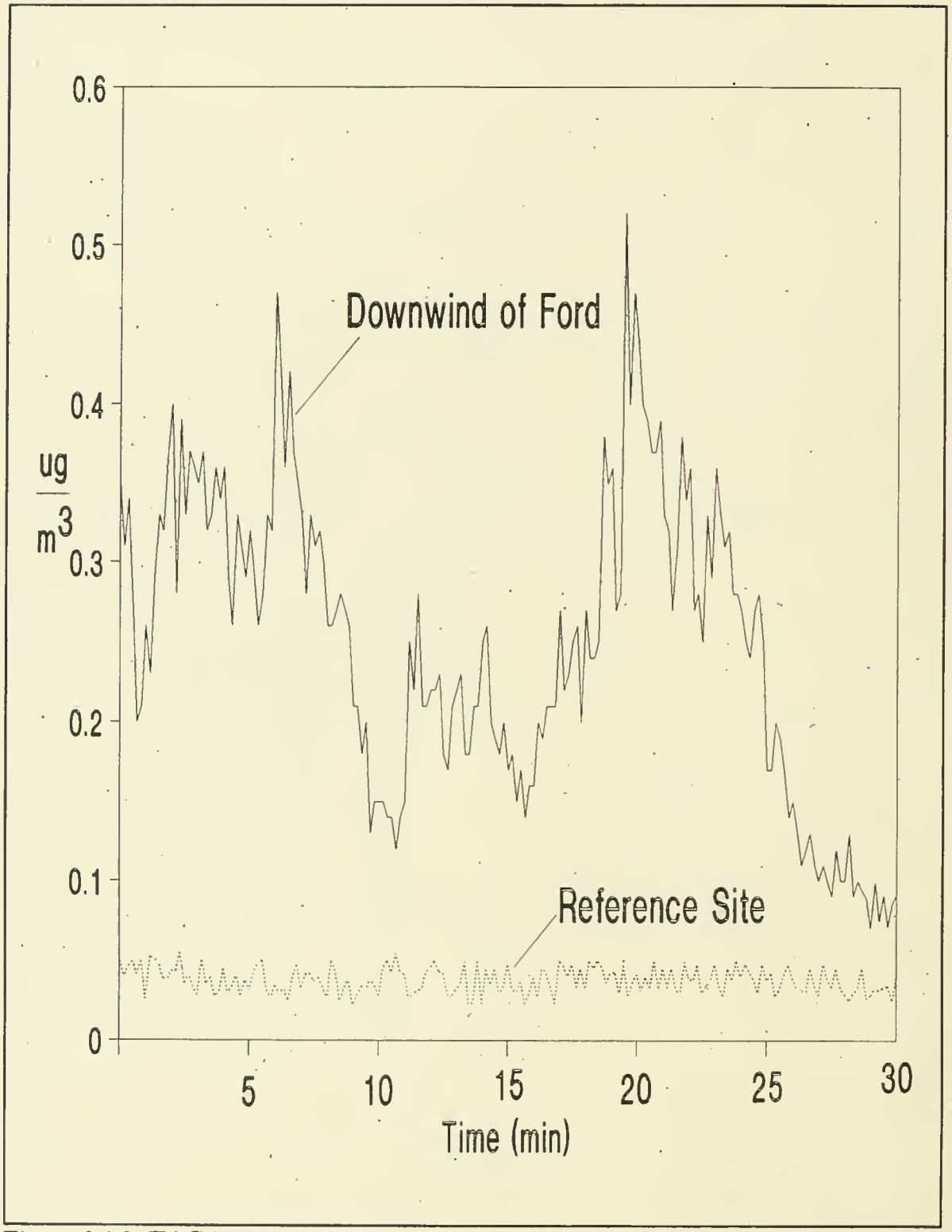

Figure 2.1.2: TAGA real-time data for dimethylamine (Ford, August 1991).
(see Table 2.1.1, S12 for downwind and S14 for reference)

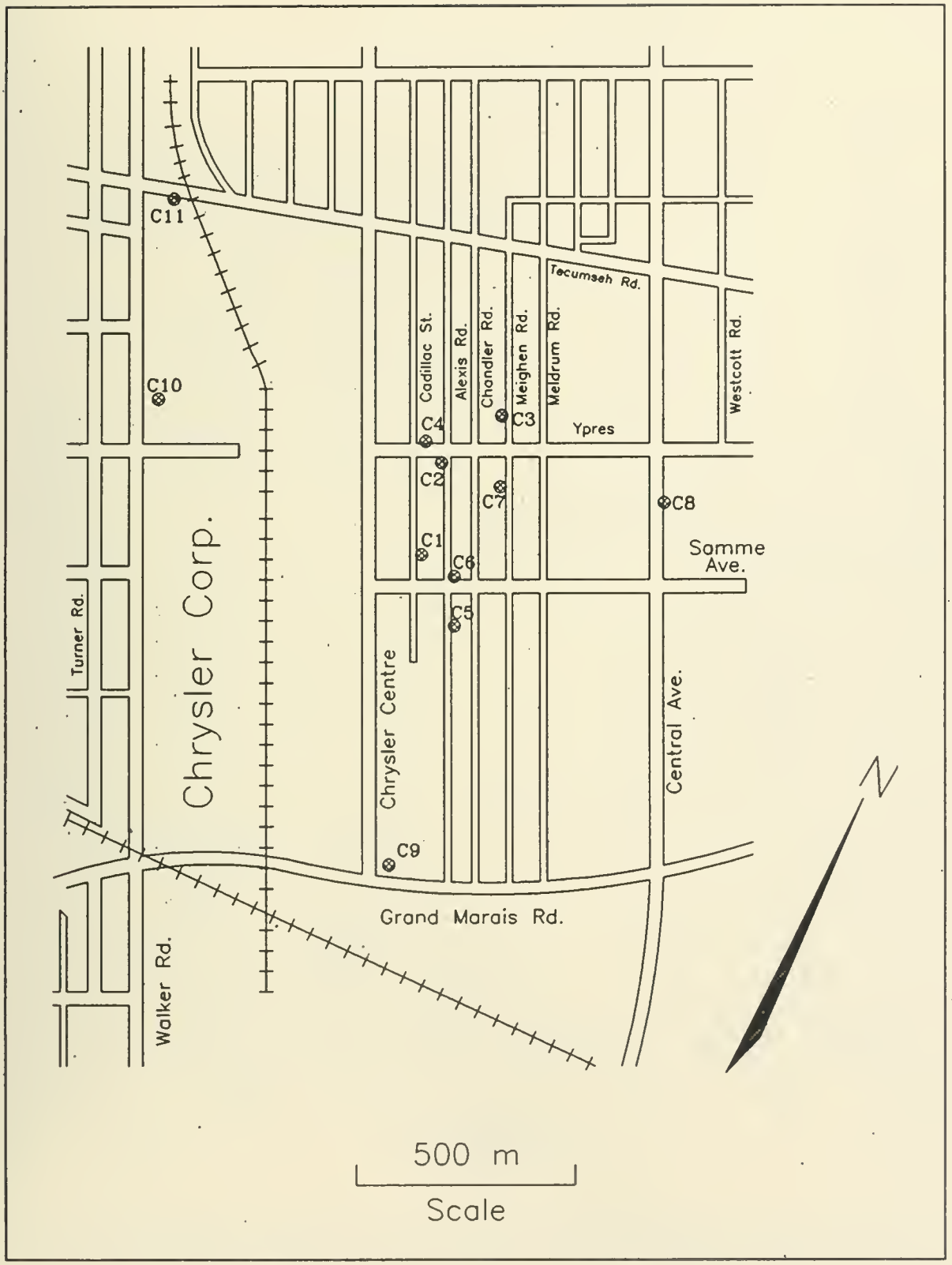

Figure 2.2.1: TAGA 6000 monitoring sites downwind of Chrysler Corp., August 1991.

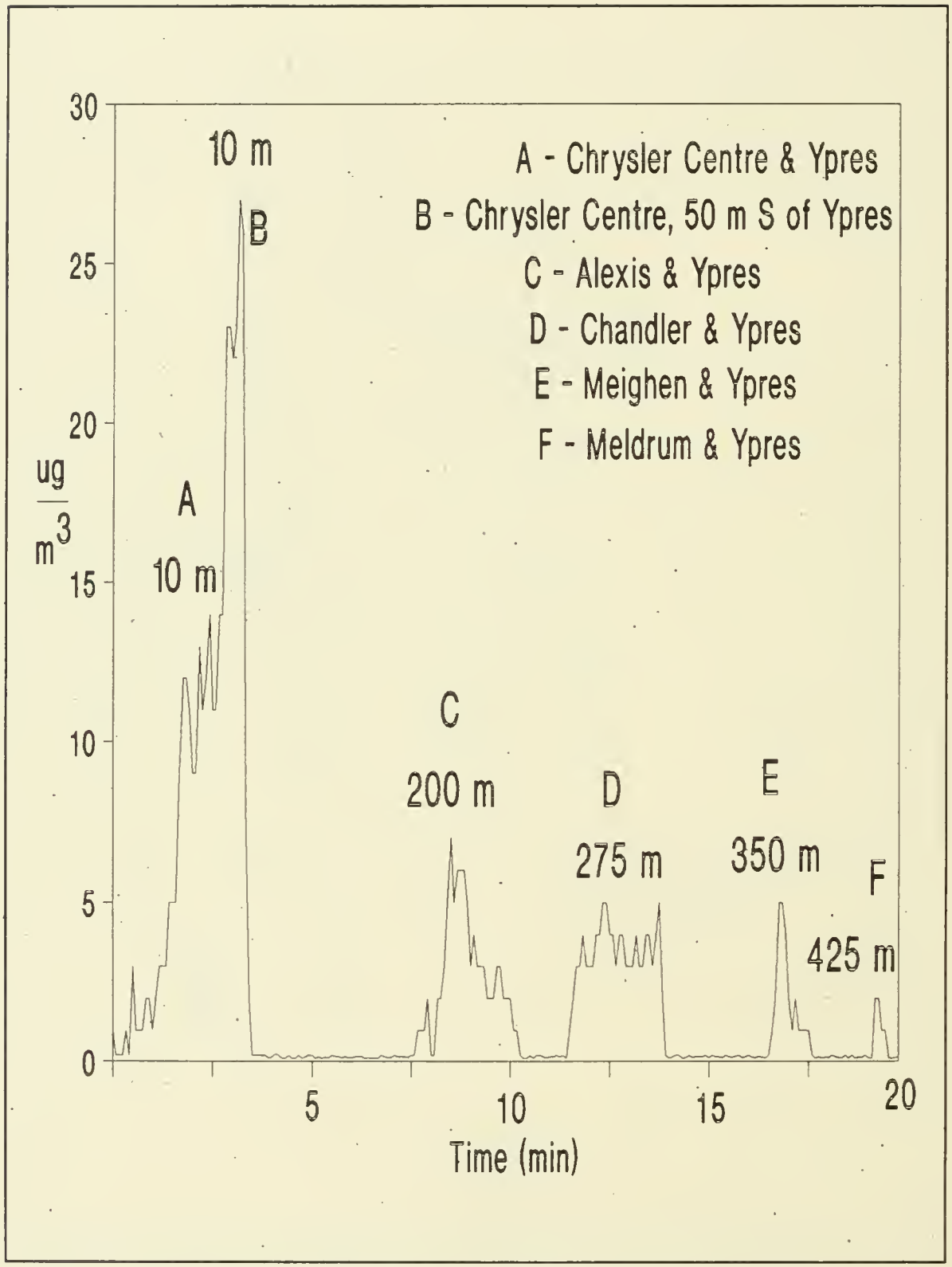

Figure 2.2.2: TAGA plume tracking for butyl cellosolve (Chrysler, August 1991).

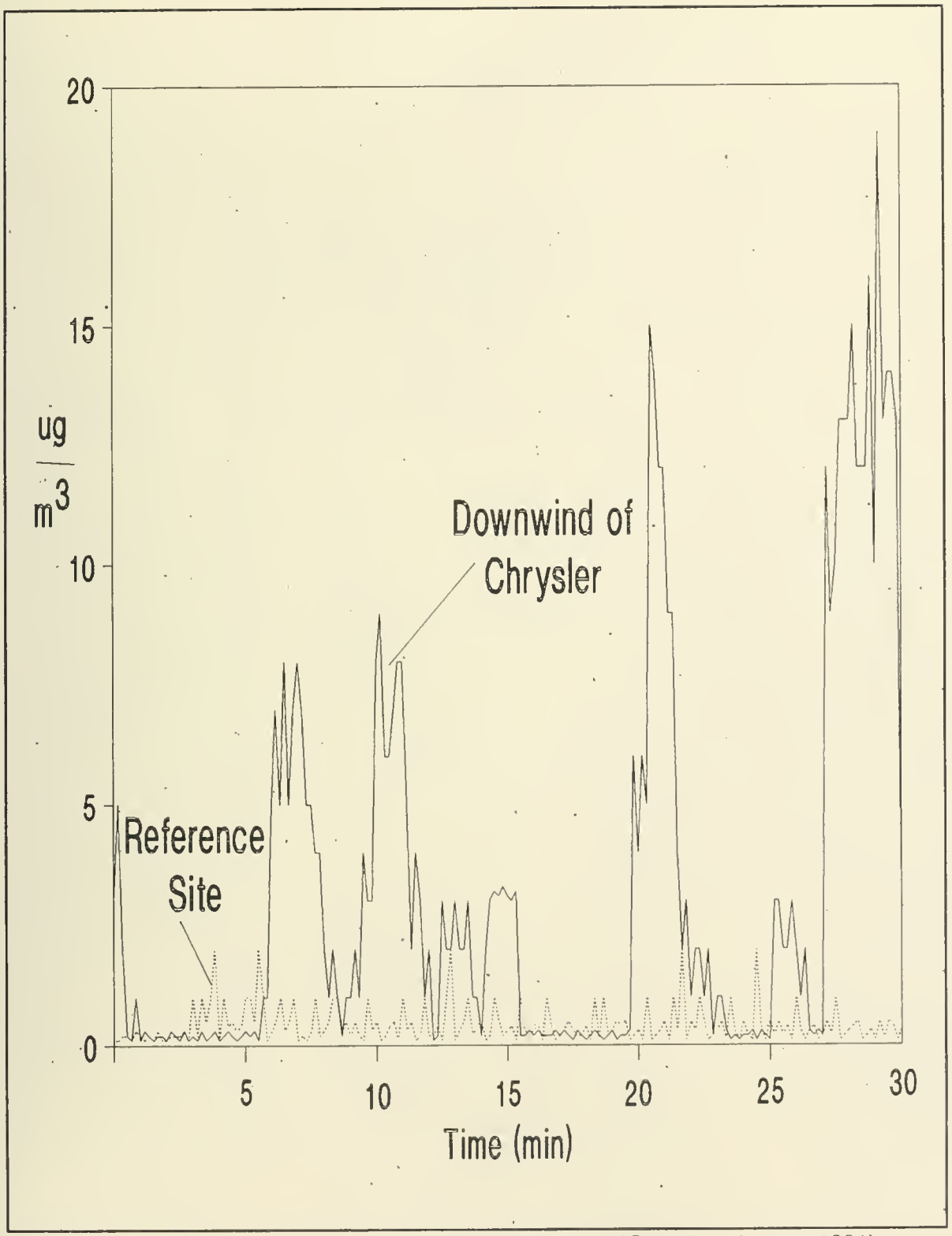

Figure 2.2.3: TAGA real-time data for butyl cellosolve (Chrysler, August 1991).
(see Table 2.2.1, S12 for downwind and S11 for reference)

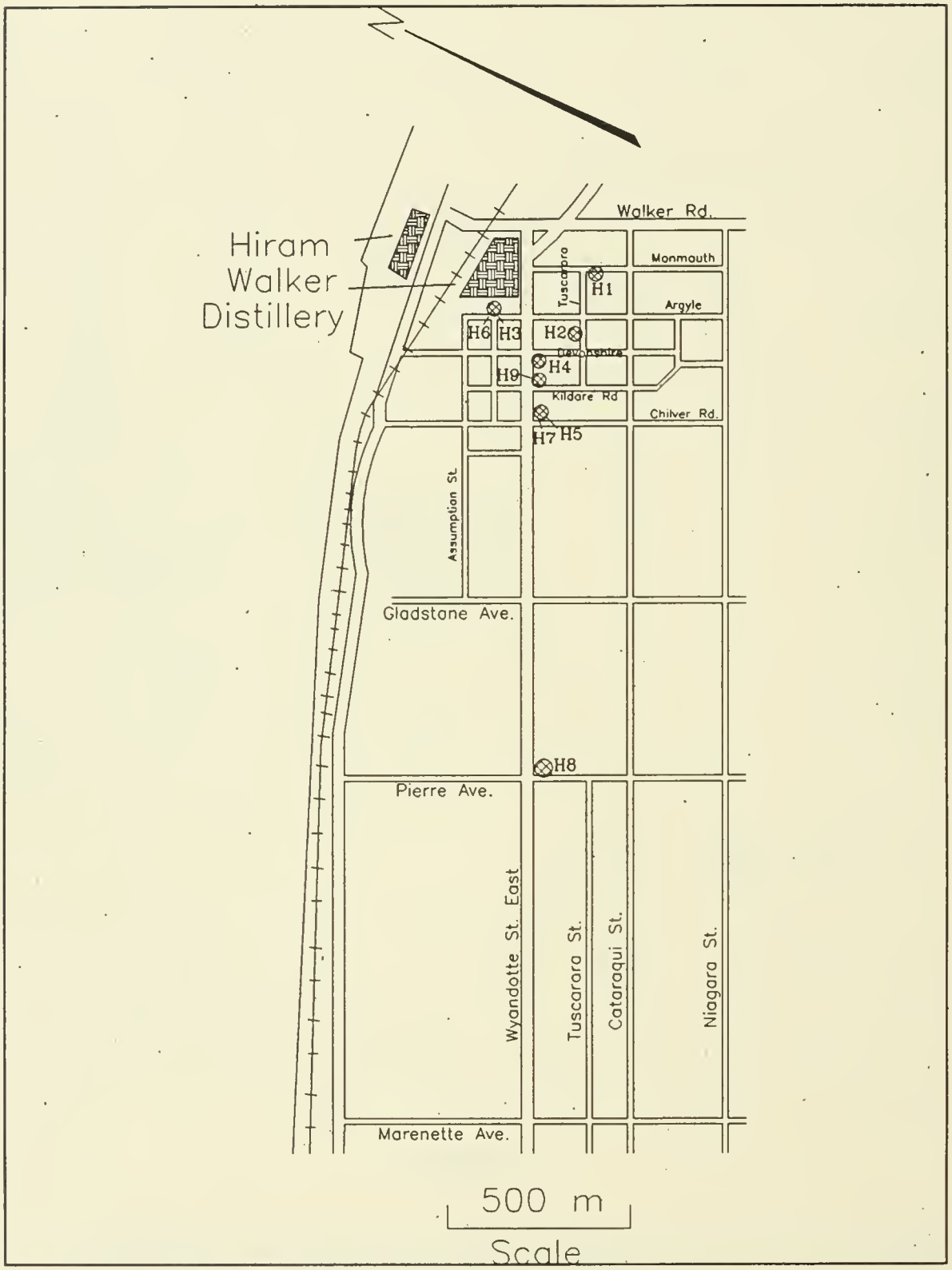

Figure 2.3.1: TAGA 6000 monitoring sites downwind of Hiram-Walker, August 1991.

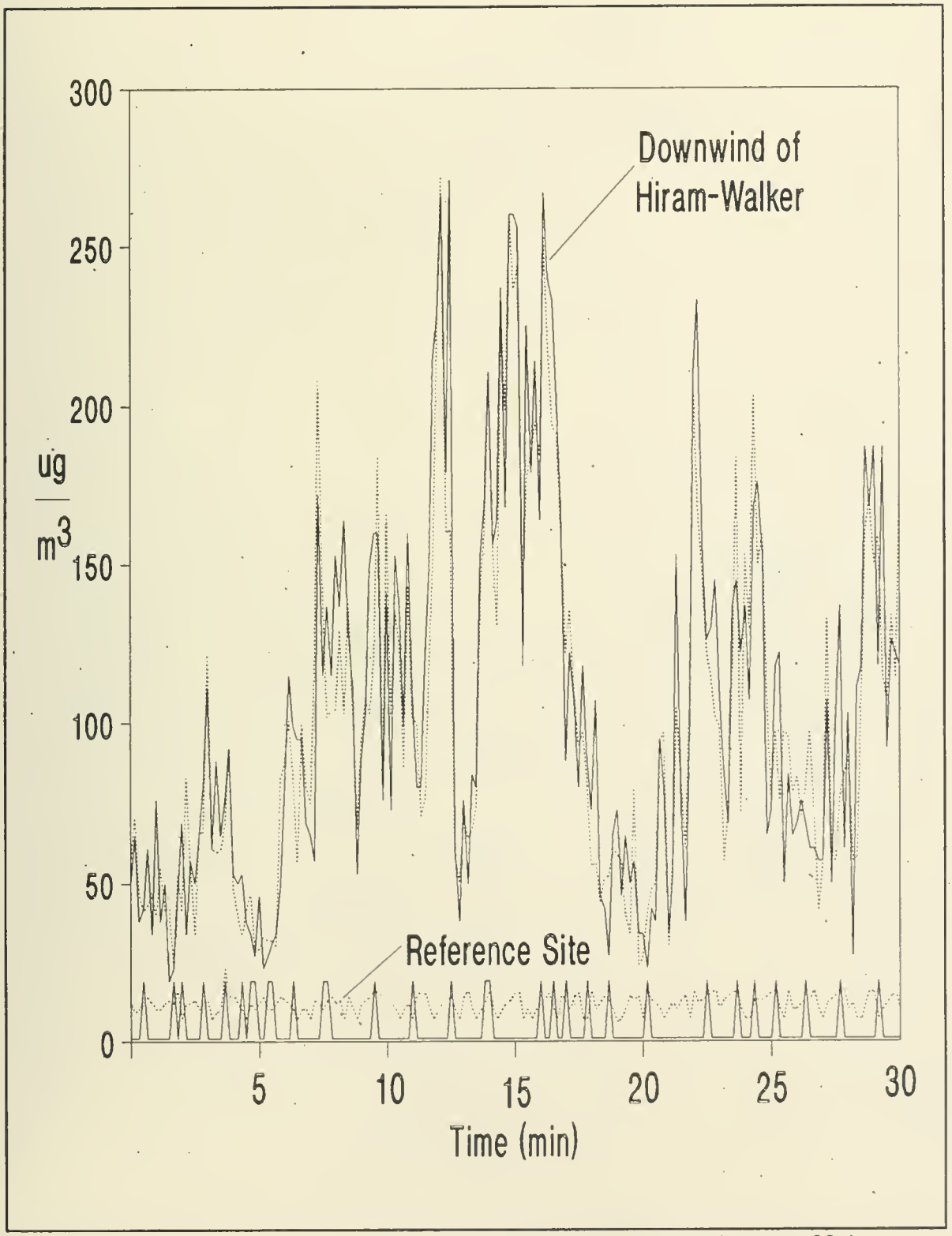

Figure 2.3.2: TAGA real-time data for ethanol (Hiram-Walker, August 1991).
(see Table 2.3.1, S19 for downwind and S09 for reference)

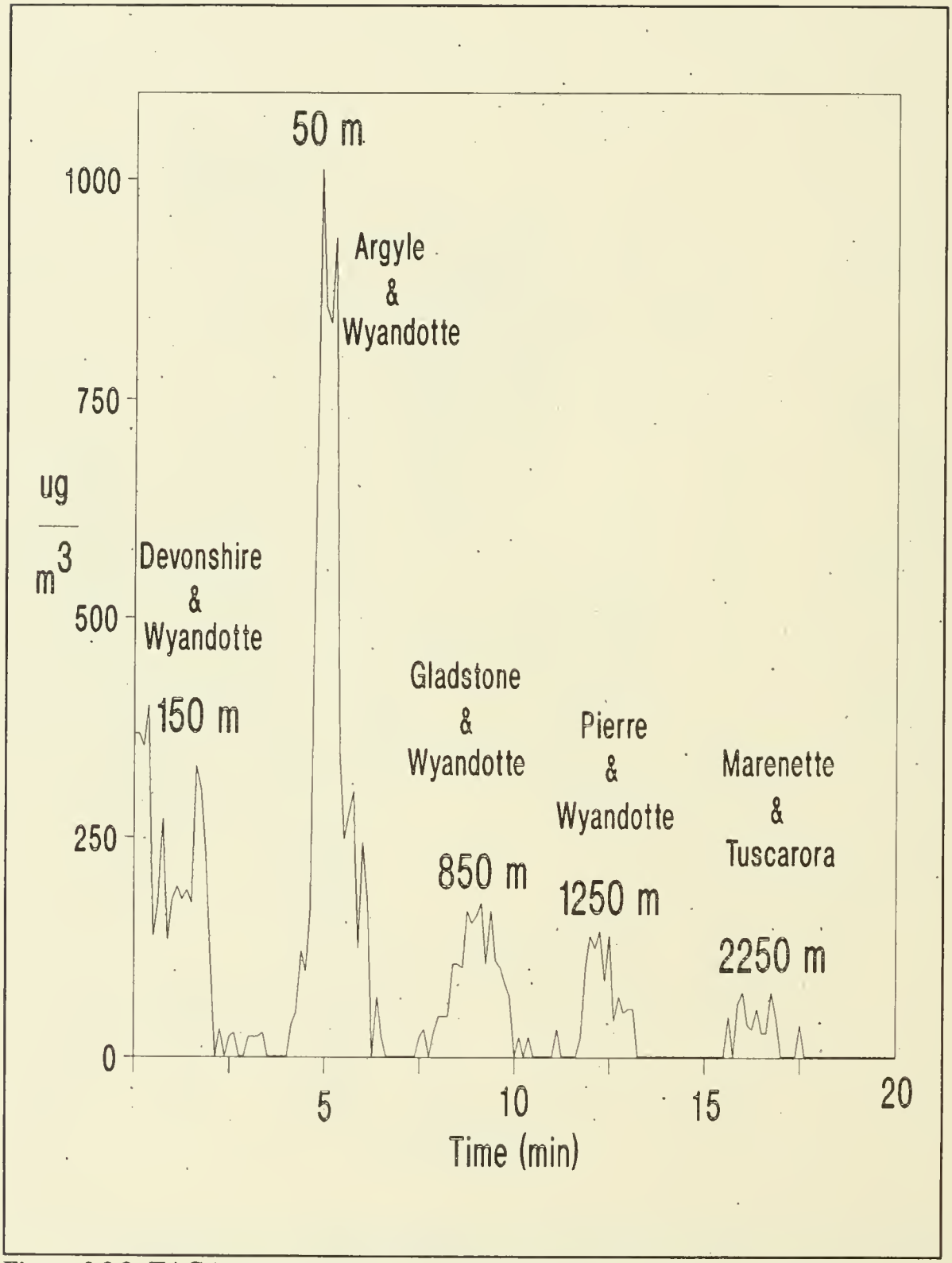

Figure 2.3.3: TAGA plume tracking for ethanol (Hiram-Walker, August 1991).

Figure 2.4.1: TAGA 6000 monitoring site in downtown Windsor, August 1991.

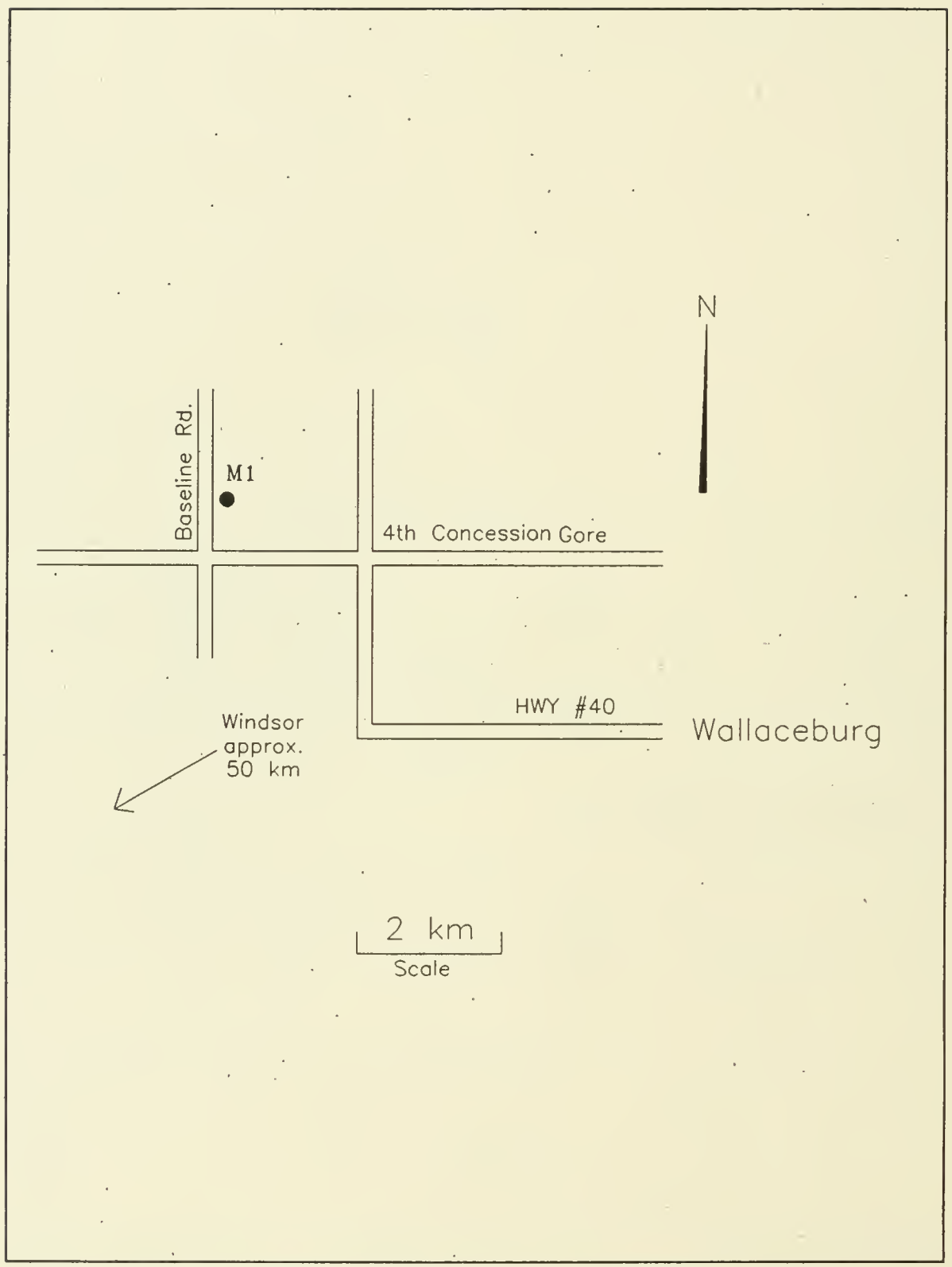

Figure 2.6.1: Mercury analyzer monitoring site near Wallaceburg, August 1991.

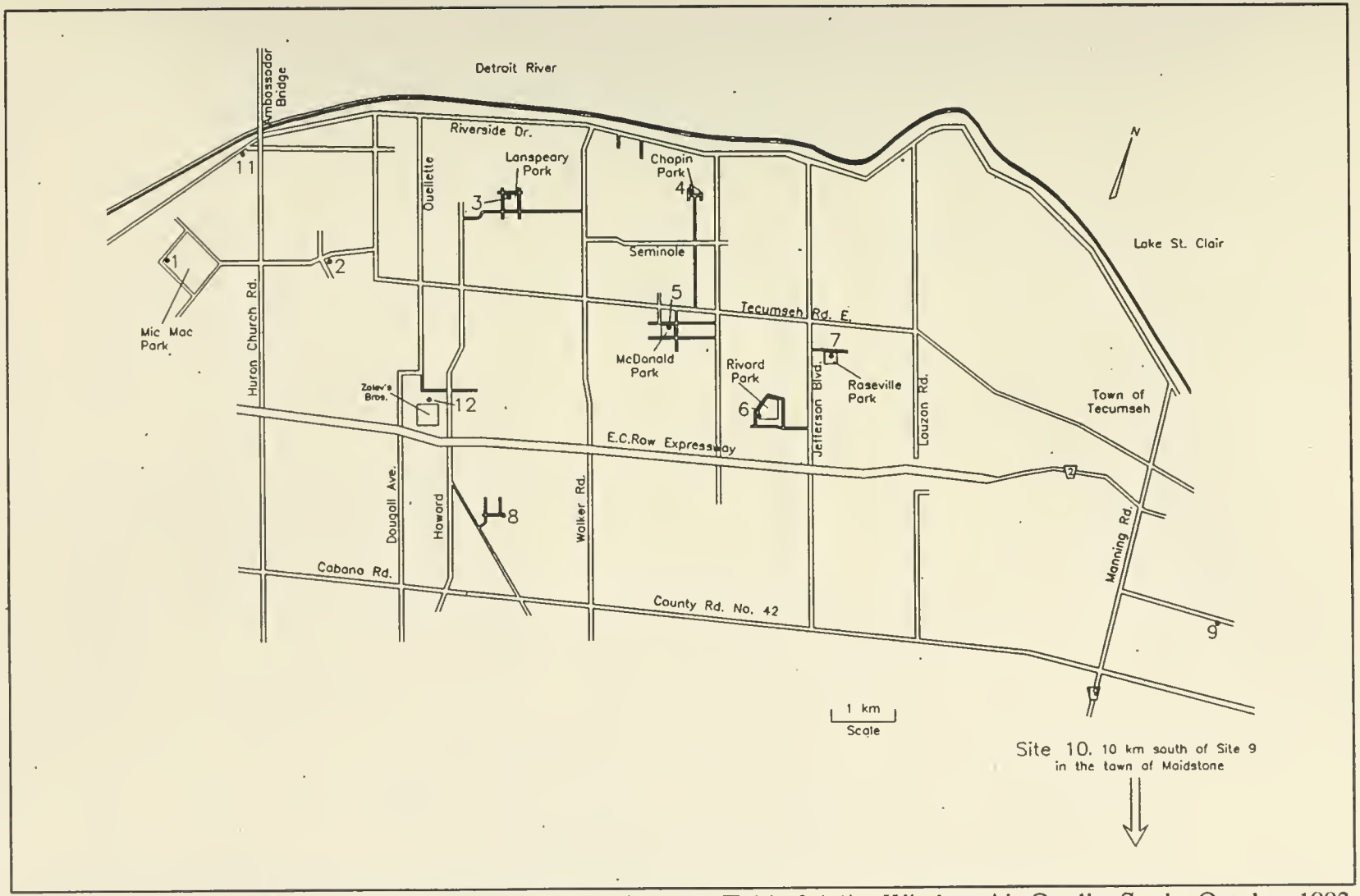

Figure 3.1.1: TAGA 6000 monitoring sites (exact locations see Table 3.1.1) - Windsor Air Quality Study, October 1992.

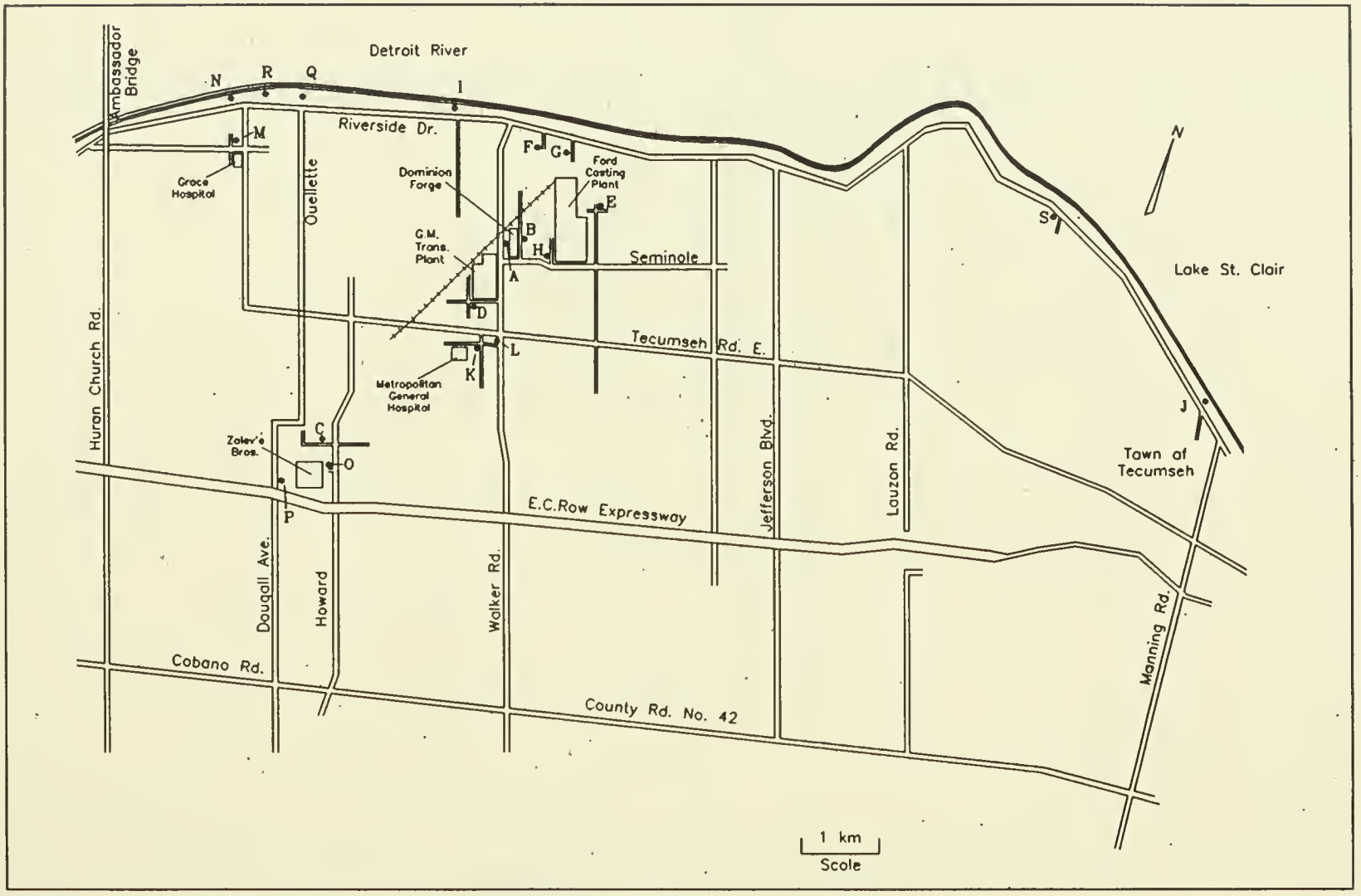

Figure 3.2.1: Monitoring sites for mercury vapour in Windsor, October 1992.

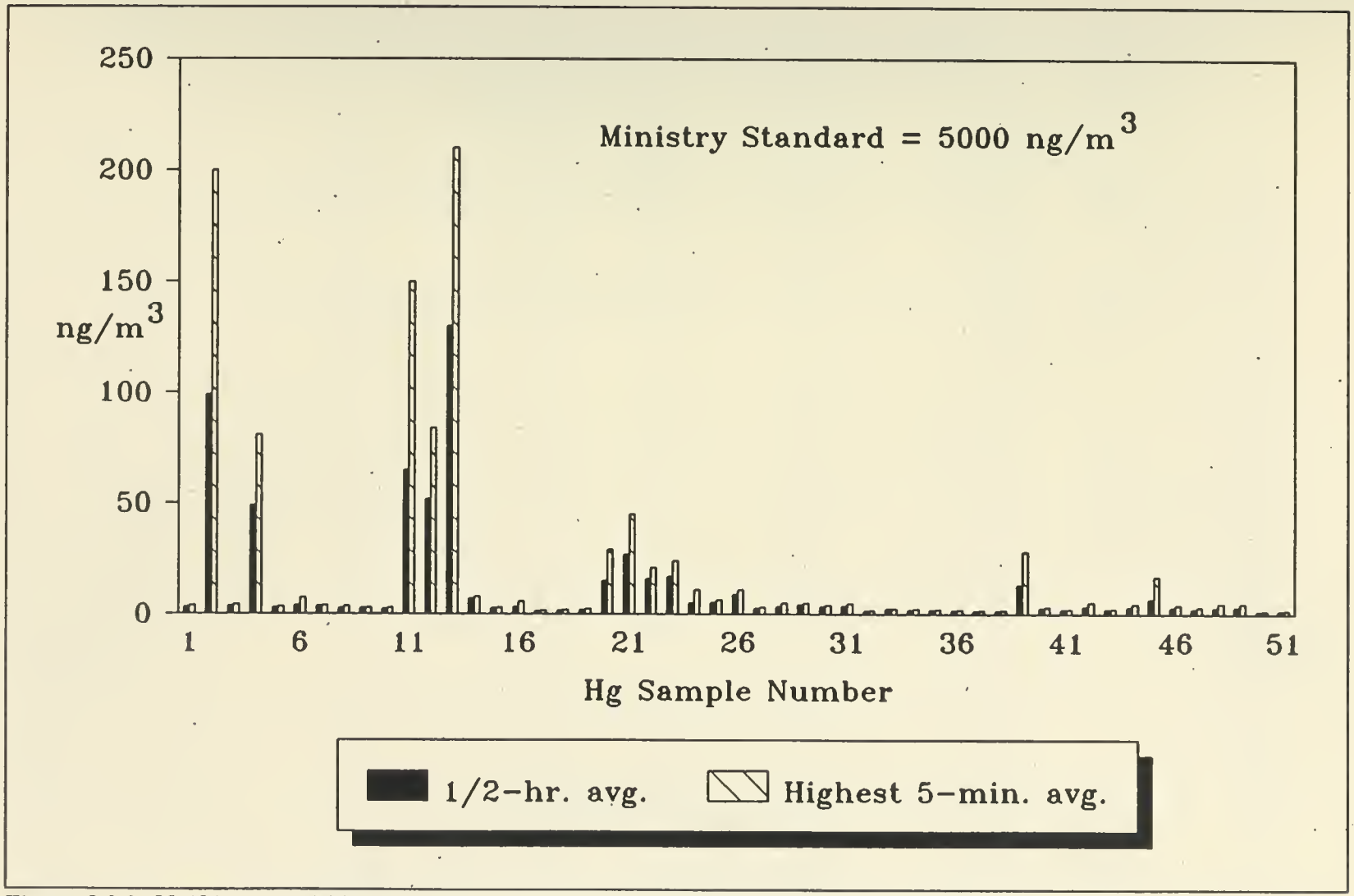

Figure 3.2.2: Half-hour and highest 5-minute average concentrations of mercury vapour in Windsor, October 1992.

Table 2.1.1: Half-Hour Average Concentrations in $\mu g/m^3$ Dimethylamine (DMA) and Dimethylnitrosamine (DMNA) Mobile TAGA 6000 Survey, (Ford) August 1991

Date	Sample Number	Start Time	Site[1]	Met. Data[2] AT	WS	WD	Concentration ($\mu g/m^3$) DMA AVE[3]	DMA MAX[4]	DMNA AVE
Aug. 12	S01	14:06	Ref	31	05-15	ENE	<.092	<.092	<.0045
	S02	15:26	F1	30	00-10	NNE	.16	.35	<.0045
	S03	15:59	F1	29	00-10	NE/NW	.13	.33	<.0045
	S04	16:31	F1	29	00-10	SE	.097	.15	<.0045
Aug. 13	S05	10:31	Ref	29	00-10	ENE	<.061	<.061	<.0021
	S06	13:03	F2	29	05-15	NNW	.14	.37	<.0021
	S07	13:34	F2	28	05-15	N	.19	.52	<.0021
	S08	14:50	F2	30	05-15	N/E	.26	.65	<.0021
	S09	15:20	F2	30	05-15	N/E	.16	.55	<.0021
	S10	15:51	F2	29	00-10	N/E	.17	.47	<.0021
	S11	16:24	F2	29	00-10	ESE	.080	.18	<.0021
	S12	17:40	F3	29	00-10	NE	.23	.52	<.0021
	S13	18:12	F3	29	00-10	SE	<.061	.10	<.0021
	S14	19:25	Ref	28	00-10	SSE	<.061	<.061	<.0021
Aug. 14	S15	11:48	Ref	27	00-10	SW	<.051	<.051	<.0014
	S16	13:52	F4	28	00-10	W	<.051	.060	<.0014
	S17	14:25	F4	29	00-05	SSW	<.051	<.051	<.0014
	S18	15:16	F5	30	05-15	W	<.051	<.051	<.0014
	S19	15:46	F5	30	00-10	S	<.051	<.051	<.0014
	S20	16:17	F5	29	05-20	S	<.051	<.051	<.0014
	S21	17:07	F6	25	00-20	NE/NW	<.051	<.051	<.0014

Notes:

1. See Figure 2.1.1 for monitoring locations.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. Half-hour average concentration in $\mu g/m^3$. TAGA detection limits determined on August 12, 13, 14: DMA = 0.092, 0.061, 0.051 $\mu g/m^3$; DMNA = 0.0045, 0.0021, 0.0014 $\mu g/m^3$.
4. Maximum instantaneous level in $\mu g/m^3$ during the half-hour sampling period.

Table 2.2.1: Half-Hour Average Concentrations in $\mu g/m^3$ Cellosolve (CELLO), Butyl Cellosolve (BUCEL) and Cellosolve Acetate (CELAC) Mobile TAGA 6000 Survey, (Chrysler) August 1991

Date	Sample Number	Start Time	Site[1]	Met. Data[2] AT	WS	WD	Concentration[3] ($\mu g/m^3$) CELLO	BUCEL	CELAC
Aug. 26	S01	09:56	Ref	27	05-15	SW	<.18	<.92	<.55
	S02	11:36	C1	29	00-10	SSW	.80	7.3	<.55
	S03	12:49	C2	31	05-15	SSW	.48	2.1	<.55
	S04	13:24	C2	31	05-15	SSW	.61	2.9	<.55
	S05	13:55	C2	32	05-15	SSW	.83	5.0	<.55
	S06	14:47	C3	30	05-20	SSW	.49	1.7	<.55
	S07	15:18	C3	30	10-25	S	.38	1.3	<.55
	S08	15:48	C3	30	10-25	SSW	.50	2.7	<.55
	S09	16:19	C3	29	10-25	SSW	.60	3.5	<.55
	S10	17:00	C4	30	05-20	SSW	.86	4.0	<.55
Aug. 27	S11	10:39	Ref	28	05-10	SW	<.19	<1.3	<.68
	S12	12:04	C5	29	00-10	SW	.51	3.3	<.68
	S13	14:22	C6	32	05-20	SW	.44	3.4	<.68
	S14	14:52	C6	32	05-20	SW	.51	4.5	<.68
	S15	15:40	C7	31	05-20	SW	.43	2.7	<.68
	S16	16:10	C7	31	05-10	SW	.52	3.2	<.68
	S17	16:41	C7	31	05-15	SW	.51	2.3	<.68
	S18	17:37	C8	32	10-20	SSW	<.19	<1.3	<.68
	S19	18:08	C8	32	10-20	SSW	<.19	<1.3	<.68
Aug. 28	S20	11:50	Ref	32	00-05	WNW	<.34	<.65	<2.2
	S21	13:30	C9	32	00-10	SW/NE	<.34	<.65	<2.2
	S22	14:19	C10	30	10-25	NE	<.34	<.65	<2.2
	S23	15:13	C11	31	10-20	SSE	.72	1.0	<2.2
	S24	15:43	C11	32	05-20	S	<.34	<.65	<2.2

Notes:
1. See Figure 2.2.1 for monitoring locations.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. Half-hour average concentration in $\mu g/m^3$. TAGA detection limits determined on August 26, 27, 28: Cellosolve = 0.18, 0.19, 0.34 $\mu g/m^3$; Butyl Cellosolve = 0.92, 1.3, 0.65 $\mu g/m^3$; Cellosolve Acetate = 0.55, 0.68, 2.2 $\mu g/m^3$.

Table 2.3.1: Half-Hour Average Concentrations in $\mu g/m^3$ Ethanol (ETHA) and Acrylonitrile (ACRY) Mobile TAGA 6000 Survey, (Hiram-Walker) August 1991

Date	Sample Number	Start Time	Site[1]	Met. Data[2] AT	WS	WD	Concentration ($\mu g/m^3$) ETHA AVE[3]	ETHA MAX[4]	ACRY AVE
Aug. 23	S01	11:21	Ref	27	00-10	ENE	<20	<20	<.36
	S02	12:36	H1	27	05-15	NE	410	2,200	<.36
	S03	13:24	H2	27	00-05	ENE	250	1,000	<.36
	S04	13:55	H2	27	00-05	ENE	190	400	<.36
	S05	14:25	H2	27	00-05	ENE	220	500	<.36
	S06	14:57	H2	26	00-05	ENE	210	450	<.36
	S07	15:29	H2	26	00-05	NE	270	500	<.36
	S08	16:37	H3	26	10-20	ENE	650	3,500	<.36
Aug. 24	S09	10:55	Ref	25	10-20	ENE	<13	<13	<.45
	S10	11:54	H4	25	05-15	ENE	650	1,000	<.45
	S11	12:25	H4	25	05-10	ENE	530	850	<.45
	S12	12:56	H4	26	05-10	ENE	520	850	<.45
	S13	13:26	H4	27	00-10	ENE	580	1,000	<.45
	S14	14:19	H5	27	05-15	ENE	220	350	<.45
	S15	14:50	H5	27	10-20	ENE	210	350	<.45
	S16	15:29	H5	27	05-15	ENE	200	350	<.45
	S17	16:33	H6	27	05-15	ENE	790	2,000	<.45
	S18	17:04	H6	26	10-20	ENE	1,200	4,000	<.45
	S19	17:53	H7	27	00-10	ENE	110	300	<.45
	S20	18:23	H7	26	00-15	ENE	220	500	<.45
Aug. 25	S21	11:54	Ref	28	05-10	ENE	<26	<26	<.26
	S22	13:01	H8	28	05-15	NE	38	200	<.26
	S23	13:32	H8	28	10-20	ENE	78	200	<.26
	S24	14:02	H8	28	05-15	ENE	45	200	<.26
	S25	15:00	H9	28	10-20	ENE	180	450	<.26

Notes:

1. See Figure 2.3.1 for monitoring locations.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. Half-hour average concentration in $\mu g/m^3$. TAGA detection limits determined on August 23, 24, 25: Ethanol = 20, 13, 26 $\mu g/m^3$; Acrylonitrile = 0.36, 0.45, 0.26 $\mu g/m^3$.
4. Maximum instantaneous level in $\mu g/m^3$ during the half-hour sampling period.

Table 2.4.1: Half-Hour Average Concentrations in $\mu g/m^3$
Dimethylamine (DMA), Ethanol (ETHA), Acrylonitrile (ACRY), Dimethylnitrosamine (DMNA)
Cellosolve (CELLO), Butyl Cellosolve (BUCEL), Cellosolve Acetate (CELAC) and Mercury (Hg)
Mobile TAGA 6000 Survey, (Downtown Windsor) August 1991

Date	Sample Number	Start Time	Site[1]	Met. Data[2]			Concentration[3] ($\mu g/m^3$)							
				AT	WS	WD	DMA	ETHA	ACRY	DMNA	CELLO	BUCEL	CELAC	Hg
Aug. 21	S01	11:55	Ref	25	05-15	N	<.096	<29	<.64	<.017	<.81	<3.3	<2.9	.017
	S02	12:56	D1	24	00-15	W	<.096	<29	<.64	<.017	<.81	<3.3	<2.9	.010
	S03	13:26	D1	24	00-10	W	<.096	<29	<.64	<.017	<.81	<3.3	<2.9	.008
	S04	13:59	D1	25	00-10	W	<.096	<29	<.64	<.017	<.81	<3.3	<2.9	<.007
	S05	14:29	D1	26	00-15	W	<.096	<29	<.64	<.017	<.81	<3.3	<2.9	<.007
	S06	15:03	D1	25	00-10	W	<.096	<29	<.64	<.017	<.81	<3.3	<2.9	<.007
	S07	15:34	D1	25	05-15	W	<.096	<29	<.64	<.017	<.81	<3.3	<2.9	<.007

Notes:
1. See Figure 2.4.1 for monitoring location.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. Half-hour average concentration in $\mu g/m^3$. TAGA detection limits determined on August 21: Dimethylamine = 0.096 $\mu g/m^3$; Ethanol = 29 $\mu g/m^3$; Acrylonitrile = 0.64 $\mu g/m^3$; Dimethylnitrosamine = 0.017 $\mu g/m^3$; Cellosolve = 0.81 $\mu g/m^3$; Butyl Cellosolve = 3.3 $\mu g/m^3$; Cellosolve Acetate = 2.9 $\mu g/m^3$; Mercury = 0.007 $\mu g/m^3$.

Table 2.5.1: Half-Hour Average Concentrations in $\mu g/m^3$
Ethanol (ETHA), Acrylonitrile (ACRY), Dimethylnitrosamine (DMNA) and Mercury (Hg)
Mobile TAGA 6000 Survey, (West Windsor) August 1991

Date	Sample Number	Start Time	Site[1]	Met. Data[2] AT	WS	WD	Concentration[3] ($\mu g/m^3$) ETHA	ACRY	DMNA	Hg
Aug. 20	S01	16:05	Ref	21	05-15	NE	<20	<.29	<.0077	<.007
	S02	17:08	W1	21	10-25	NE	<20	<.29	<.0077	<.007
	S03	17:39	W1	22	05-15	E	<20	<.29	<.0077	<.007
	S04	18:16	W1	21	10-20	NE	<20	<.29	<.0077	<.007
	S05	18:49	W1	21	05-20	NE	<20	<.29	<.0077	<.007
	S06	19:24	W1	21	10-20	NE	<20	<.29	<.0077	<.007
	S07	19:55	W1	21	10-20	NE	<20	<.29	<.0077	<.007
	S08	20:26	W1	20	10-15	NE	<20	<.29	<.0077	<.007
	S09	20:57	W1	20	05-10	NE	<20	<.29	<.0077	<.007
Aug. 21	S10	11:55	Ref	24	00-10	NW	<29	<.64	<.017	.017
	S11	16:39	W2	26	10-25	W	<29	<.64	<.017	.009
	S12	17:10	W2	26	05-25	W	<29	<.64	<.017	.012
	S13	17:55	W2	25	10-25	SW	<29	<.64	<.017	.014
	S14	18:41	W3	26	10-20	SSW	<29	<.64	<.017	.016
	S15	19:11	W3	24	10-20	SSW	<29	<.64	<.017	.020
	S16	19:41	W3	24	10-20	SSW	<29	<.64	<.017	.019
	S17	20:11	W3	23	10-20	SSW	<29	<.64	<.017	.015
	S18	20:41	W3	22	10-15	SSW	<29	<.64	<.017	.010
Aug. 28	S19	11:19	Ref	32	00-05	W	<19	<.21	<.0080	n/a
	S20	16:50	W4	32	00-15	SW	<19	<.21	<.0080	n/a
	S21	17:21	W4	30	00-10	WSW	<19	<.21	<.0080	n/a
	S22	17:52	W4	30	05-15	SSW	<19	<.21	<.0080	n/a
	S23	18:22	W4	29	00-10	S	<19	<.21	<.0080	n/a

Notes:
1. See Figure 2.0.1 for monitoring locations.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. Half-hour average concentration in $\mu g/m^3$. TAGA detection limits determined on August 20, 21, 28: Ethanol = 20, 29, 19 $\mu g/m^3$; Acrylonitrile = 0.29, 0.64, 0.21 $\mu g/m^3$; DMNA = 0.0077, 0.017, 0.0080 $\mu g/m^3$; Mercury = 0.007, 0.007 $\mu g/m^3$, (not monitored on Aug. 28).

Table 2.6.1: Half-Hour Average Concentrations of Mercury in $\mu g/m^3$ Mobile TAGA 6000 Survey, (Wallaceburg) August 1991

Date	Sample Number	Start Time	Site[1]	Met. Data[2] AT	WS	WD	Conc[3] ($\mu g/m^3$) Mercury
Aug. 22	S01	12:50	M1	29	20-35	SW	.017
	S02	13:20	M1	27	20-35	SW	.012
	S03	13:50	M1	29	25-40	SW	.013
	S04	14:20	M1	28	15-30	SW	.013
	S05	14:50	M1	30	20-30	SW	.018
	S06	15:20	M1	30	15-25	WSW	.016
	S07	15:50	M1	30	15-25	WSW	.014
	S08	16:20	M1	31	15-25	WSW	.012
	S09	19:50	Ref	27	00-10	NW/NE	.018

Notes:
1. See Figure 2.6.1 for monitoring locations.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. Half-hour average concentration in $\mu g/m^3$. The analyzer's detection limit was 0.009 $\mu g/m^3$.

Table 3.1.1: Mobile TAGA 6000 Monitoring Locations and Periods
Windsor Air Quality Study: October 1992

Site[1]	Location	Date	Time	AT[2]	WS[3]	WD[4]
1	Prince & Matchette (park)	Oct. 26	17:57 - 20:03	10	00 - 05	NE
	"	Oct. 27	15:56 - 19:20	17	00 - 05	E
2	Tecumseh & Cambell	Oct. 28	15:41 - 16:36	17	15 - 30	S
3	Giles & Langlois (park)	Oct. 20	11:17 - 14:38	03	10 - 20	S
	"	Oct. 22	17:35 - 18:03	13	05 - 10	S
4	Franklin & Rossini (park)	Oct. 15	10:41 - 11:48	15	05 - 10	SW
	"	Oct. 15	12:16 - 13:17	16	00 - 05	WSW
	"	Oct. 28	13:41 - 14:50	17	10 - 25	SSW
5	Ypres & Westcott (park)	Oct. 27	12:16 - 13:36	15	00 - 10	E
6	Rivard (park)	Oct. 14	13:48 - 17:02	21	00 - 10	WSW
	"	Oct. 28	11:42 - 13:06	16	10 - 25	SW
7	Roseville (park)	Oct. 22	15:05 - 16:14	15	10 - 20	S
	"	Oct. 29	10:56 - 11:42	14	05 - 15	NNW
8	Foster & Devon	Oct. 21	12:04 - 14:06	12	05 - 20	NNW
	"	Oct. 27	14:09 - 14:54	13	05 - 10	ESE
9	Manning & Little Base (Rural)	Oct. 14	10:10 - 10:36	15	15 - 25	S
	"	Oct. 15	09:38 - 09:51	15	05 - 10	S
	"	Oct. 19	15:49 - 16:14	06	15 - 25	NNW
	"	Oct. 20	10:13 - 10:35	02	30 - 45	S
	"	Oct. 21	10:28 - 11:01	08	15 - 30	NNW
	"	Oct. 22	13:59 - 14:21	14	15 - 25	S
	"	Oct. 26	16:52 - 17:17	14	05 - 10	NNE
	"	Oct. 27	10:37 - 11:38	14	05 - 15	NNE
	"	Oct. 28	10:15 - 10:45	12	15 - 25	SW
	"	Oct. 29	10:08 - 10:25	13	20 - 30	NNW
10	Maidstone (Rural)	Oct. 19	16:53 - 17:46	05	05 - 10	NW
11	Ambassador Bridge	Oct. 28	17:04 - 20:19	14	15 - 25	SW
12	Zalev's Bros.	Oct. 27	19:51 - 21:37	07	00 - 05	SE

1. See Figure 3.1.1. 2. Ambient temperature (°C). 3. Wind speed (km/hr). 4. Wind direction.

Table 3.1.2: TAGA 6000 Approximate Instantaneous Concentrations (μg/m³) of Selected Compounds Windsor Air Quality Study: October 1992

Site[1]	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Ethyl alcohol	290	140	nd[2]	nd	nd	nd	nd	230	nd	nd	170	nd
Acetone	5.0	11	7.5	7.5	10	13	13	11	5.0	15	6.0	35
Iso-propyl alcohol	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ethylene glycol	40	15	50	9.0	75	13	7.5	35	5.0	15	nd	70
Methyl ethyl ketone	16	85	13	8.0	7.4	11	9.6	18	nd	nd	nd	16
Ethyl acetate	5.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	12
Methyl iso-butyl ketone	5.0	16	1.5	nd	1.9	2.0	2.5	3.0	nd	nd	1.0	33
n-Butyl acetate	6.6	nd	3.6	nd	3.3	5.1	nd	3.6	nd	nd	nd	nd
2-Ethyl hexanol	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Toluene	11	7.1	5.4	5.4	5.4	nd	7.1	7.1	nd	nd	3.6	21
Phenol	1.5	2.3	nd	1.2	3.1	nd	nd	1.5	1.5	nd	2.3	nd
Xylenes	11	nd	8.8	2.4	4.1	12	2.4	5.9	nd	nd	2.4	29
Trimethylbenzenes	7.1	1.8	2.6	1.8	1.5	1.8	1.0	2.1	nd	2.1	1.2	21
Naphthalene	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

1. See Figure 3.1.1 and Table 3.1.1 for monitoring sites. 2. nd = Not detected above the TAGA's detection limit.

Table 3.1.3: Ministry Standard and Odour Threshold Values
Fourteen Target Compounds
Windsor Air Quality Study: October 1992

Chemical	Ministry Standard[1]	Odour Threshold[2]
Ethyl alcohol	19,000 (IS, O)	19,000[b]
Acetone	48,000 (S, O)	32,000[a]
Iso-propyl alcohol	24,000 (IS, O)	8,000[b]
Ethylene glycol	n/a	13,000[a]
Methyl ethyl ketone	31,000 (S, O)	4,800[a]
Ethyl acetate	19,000 (S, O)	23,000[b]
Methyl iso-butyl ketone	1,200 (IS, O)	400[b]
n-Butyl acetate	735 (IS, O)	30[b]
2-Ethyl hexanol	600 (IS, O)	400[b]
Toluene	2,000 (S, O)	600[b]
Phenol	100 (S, H)	22[b]
Xylenes[3]	2,300 (S, O)	800[b]
Trimethylbenzenes[4]	500 (IS, O)	700[b]
Naphthalene	36 (IS, O)	300[b]

Notes:

1. Summary of point of impingement standards, ambient air quality criteria (AAQCs), and approvals screening levels (ASLs). Ontario Ministry of the Environment (August 1992). In $\mu g/m^3$: (S) = Air Quality Standard; (IS) = Interim Standard; (O) = Based on Odours; (H) = Based on Health Effects; n/a = not available.
2. Minimum odour threshold values in $\mu g/m^3$.
   a. Procedure for the determination of odour impact models by the binary port odour panel method. Ontario Ministry of the Environment, Report # AMP-143 (Feb.'89), Draft # 10.
   b. Gemert van, L.J. Central Institute for Nutrition and Food Research TNO, Netenbreizer, A.H., National Institute for Water Supply, Compilation of odour threshold values in air and water, Netherlands, 1977.
3. Based on 1,4-Dimethylbenzene.
4. Based on 1,2,4-Trimethylbenzene.

Table 3.2.1: Half-Hour Average Concentrations (TWA) of Mercury Vapour (Hg) Windsor Air Quality Study: October 1992

Date	Sample Number	Start Time	Site[1]	Meteorology[2] AT	WS	WD	Concentration (ng/m^3) TWA[3]	Peak[4]	Comments
Oct. 14	S01	11:45	A	15	SW	00-05	3.2	3.8	DW of GM Transmission Plant
	S02	15:40	B	21	WSW	00-10	99	200	DW of Dominion Forge
	S03	16:30	A	21	WSW	00-05	3.5	4.2	UW of Dominion Forge, DW of GM
	S04	17:15	B	21	WSW	00-05	49	81	DW of Dominion Forge
Oct. 15	S05	11:04	C	15	SW	05-10	2.9	3.4	DW of Zalev's Brothers
	S06	11:34	C	15	SW	05-10	3.8	7.3	DW of Zalev's Brothers
	S07	12:04	C	15	SW	05-10	3.5	3.9	DW of Zalev's Brothers
	S08	12:34	C	16	WSW	00-05	2.7	3.5	DW of Zalev's Brothers
	S09	13:04	C	16	WSW	00-05	2.7	3.0	DW of Zalev's Brothers
	S10	13:34	C	16	WSW	00-05	2.4	2.8	DW of Zalev's Brothers
	S11	15:34	B	16	SW	00-05	65	150	DW of Dominion Forge
	S12	16:04	B	16	SW	00-05	52	84	DW of Dominion Forge
	S13	16:34	B	16	SW	00-05	130	210	DW of Dominion Forge
	S14	17:09	A	16	SW	00-05	7.0	7.9	UW of Dominion Forge, DW of GM
	S15	17:49	D	16	SW	00-05	2.6	2.9	UW of GM Transmission Plant
Oct. 19	S16	17:35	E	05	NW	05-10	3.2	5.8	DW of Ford Casting Plant
	S17	18:10	F	05	NW	05-10	1.5	1.7	UW of Ford Casting Plant
Oct. 20	S18	10:32	A	02	S	30-45	1.7	2.0	UW of Dominion Forge
	S19	11:02	A	03	S	10-20	2.0	2.3	UW of dominion Forge
	S20	11:47	B	03	S	10-20	15	29	DW of Dominion Forge
	S21	12:17	B	03	S	10-20	27	45	DW of Dominion Forge
	S22	12:47	B	03	S	10-20	16	21	DW of Dominion Forge
	S23	13:17	B	03	S	10-20	17	24	DW of Dominion Forge
	S24	14:27	G	03	S	10-20	5.1	11	DW of Ford Casting Plant
	S25	14:57	G	03	S	10-20	5.2	6.5	DW of Ford Casting Plant
	S26	15:27	G	03	S	10-20	8.7	11	DW of Ford Casting Plant
	S27	16:02	H	03	S	10-20	2.7	3.2	UW of Ford Casting Plant
Oct. 21	S28	13:17	I	12	NNW	05-20	3.4	5.1	DW of Detroit
	S29	13:47	I	12	NNW	05-20	4.2	5.1	DW of Detroit
	S30	14:17	I	12	NNW	05-20	3.4	4.0	DW of Detriot
	S31	14:47	I	12	NNW	05-20	3.6	4.8	DW of Detroit
	S32	16:32	J	12	NNW	05-20	1.4	1.6	Not DW of Detroit
Oct. 22	S33	12:35	K	14	S	15-25	2.4	2.5	DW of Metropolitan General Hospital
	S34	13:20	L	14	S	15-25	1.9	2.4	DW of Metropolitan General Hospital
	S35	14:20	M	14	S	15-25	1.8	2.1	DW of Grace Hospital
	S36	14:50	M	14	S	15-25	1.6	1.8	DW of Grace Hospital
	S37	15:20	N	15	S	10-20	1.4	1.7	DW of Grace Hospital
	S38	15:50	N	15	S	10-20	1.4	1.7	DW of Grace Hospital
Oct. 28	S39	09:55	O	12	SW	15-25	13	28	DW of Zalev's Brother
	S40	11:43	O	16	SW	10-25	2.6	3.1	DW of Zalev's Brother
	S41	12:53	P	16	SW	10-25	1.9	2.1	UW of Zalev's Brother
Oct. 29	S42	10:48	Q	14	NNW	05-15	3.4	5.2	DW of Detroit
	S43	11:18	Q	14	NNW	05-15	2.2	2.5	DW of Detroit
	S44	11:48	Q	14	NNW	05-15	3.2	4.6	DW of Detroit
	S45	12:18	Q	15	NNW	05-15	6.6	17	DW of Detroit
	S46	12:48	Q	15	NNW	05-15	3.0	4.1	DW of Detroit
	S47	13:18	Q	15	NNW	05-15	2.1	3.2	DW of Detroit
	S48	13:48	Q	15	NNW	05-15	3.0	4.7	DW of Detroit
	S49	14:33	R	15	NNW	05-15	3.2	4.8	DW of Detroit
	S50	18:18	S	15	NNW	05-15	1.2	1.5	Not DW of Detroit
	S51	18:48	S	15	NNW	05-15	1.3	1.6	Not DW of Detroit

Notes: 1. See Figure 3.2.1 and Table 3.2.2 for monitoring locations.
2. AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. TWA=time weighted average - half-hour average (average of six 5-minute averages).
4. Peak=highest of the six 5-minute averages.

Table 3.2.2: Locations of Hg Monitoring Sites
Windsor Air Quality Study: October 1992

Site	Location
A	East side of Walker Rd., north of Seminole St., just south of R.R. tracks
B	On St. Luke St., moving between R.R. tracks & Seminole St.
C	Traversing across Edinborough St. to Howard Ave.
D	Parking lot at the intersection of Seneca St. & Kildare Rd.
E	Northeast corner of Ontario St. & Central Ave. (north of Seminole St.)
F	Intersection of Wyandotte St. & Cadillac St.
G	30m northwest of Wyandotte & Pratt Ave.
H	Intersection of Seminole St. & Cadillac St.
I	Chilver Rd. & Riverside Dr. (on gravel road beside river)
J	Town of Tecumesh, St. Clair Beach, 3 km east of Lesperance, just north of Riverside Rd., 30m from river
K	Lens Ave. & Bying Rd.
L	Walker Rd. & Tecumseh Rd.
M	Oak St. & University Ave.
N	Ambassador Park, foot of Oak St.
O	Charles St. & Howard Ave., west side of Howard at side entrance to Zalev's
P	Parking lot of Preney Print & Litho Inc., northeast corner of Ouellette Ave. & E.C. Expressway
Q	Dippe Garden (Park), Ouellette Ave. & Riverside Dr., 15m from the river
R	Ramada Inn parking lot, Bruce St. & Riverside Dr., 10m from the river
S	Florence Ave. & Riverside Dr. (southeast corner in parking lot)

Table 4.0.1: Comparison of Survey Results with Ministry Standards
Half-Hour Average Concentration Data from the TAGA 6000 Windsor Air Quality Study: August 1991

Compound Name	Chemical Formula	Range of Half-Hour Average Concentrations (µg/m³) by Receptor Type								Ministry Standard[2]	Effect[2]	Ministry Status[2]
		Industry East Windsor	(N, n)[1]	Downtown Windsor	(N, n)	West Windsor	(N, n)	Rural Area	(N, n)			
Dimethylamine	C_2H_7N	<.051-.26	(17, 7)	<.051-<.096	(11, 11)	na[3]	(0, 0)	na	(0, 0)	1,840[4]	H & O	UD
Ethanol	C_2H_6O	38-1200	(22, 0)	<13-<29	(13, 13)	<19-<29	(20, 20)	na	(0, 0)	19,000	O	IS
Acrylonitrile	C_3H_3N	<.26-<.45	(22, 22)	<.26-<.64	(13, 13)	<.21-<.64	(20, 20)	na	(0, 0)	300	H	IS
Dimethylnitrosamine	$C_2H_6N_2O$	<.0014-<.0045	(17, 17)	<.0014-<.0045	(14, 14)	<.0077-<.017	(20, 20)	na	(0, 0)	-	H	CARC
Cellosolve	$C_4H_{10}O_2$	<.19-.86	(21, 5)	<.18-<.81	(10, 10)	na	(0, 0)	na	(0, 0)	800	O	IS
Butyl cellosolve	$C_6H_{14}O_2$	<.65-7.3	(21, 5)	<.65-<3.3	(10, 10)	na	(0, 0)	na	(0, 0)	350	O	IS
Cellosolve acetate	$C_6H_{12}O_3$	<.55-<2.2	(21, 21)	<.65-2.9	(10, 10)	na	(0, 0)	na	(0, 0)	220	O	IS
Mercury	Hg	na	(0, 0)	<.0070-.020	(11, 5)	<.0070-.020	(16, 8)	.012-.018	(8, 0)	5	H	S

Notes:

1. N = Number of half-hour samples; n = number of half-hour samples the target compound was not detected (see Tables 2.1.1 to 2.6.1).
2. Summary of point of impingement standards, ambient air quality criteria (AAQCs), and approvals screening levels (ASLs). Ontario Ministry of the Environment (August 1992).
   Ministry standards for half-hour average in µg/m³.
   Based on odour (O) or Health (H).
   UD=under development, or odour threshold review; IS=interim standard; S=standard; CARC=carcinogen.
3. na = not available
4. Based on one-hour average (µg/m³).

6.0 Appendices

6.1 Appendix A: Monitoring Results and Relevant Information of the Windsor 1990 Survey

Figure 6.1.1 shows the downwind monitoring sites for HCl in the City of Windsor and the half-hour average concentrations are reported in Table 6.1.1. Figure 6.1.2 shows the monitoring sites downwind of Windsor Ford Casting Plant. The relevant information is outlined in Table 6.1.2 and the odour fingerprints are reported in Table 6.1.3. Half-hour average concentrations of Hg recorded during this survey are summarized in Table 6.1.4.

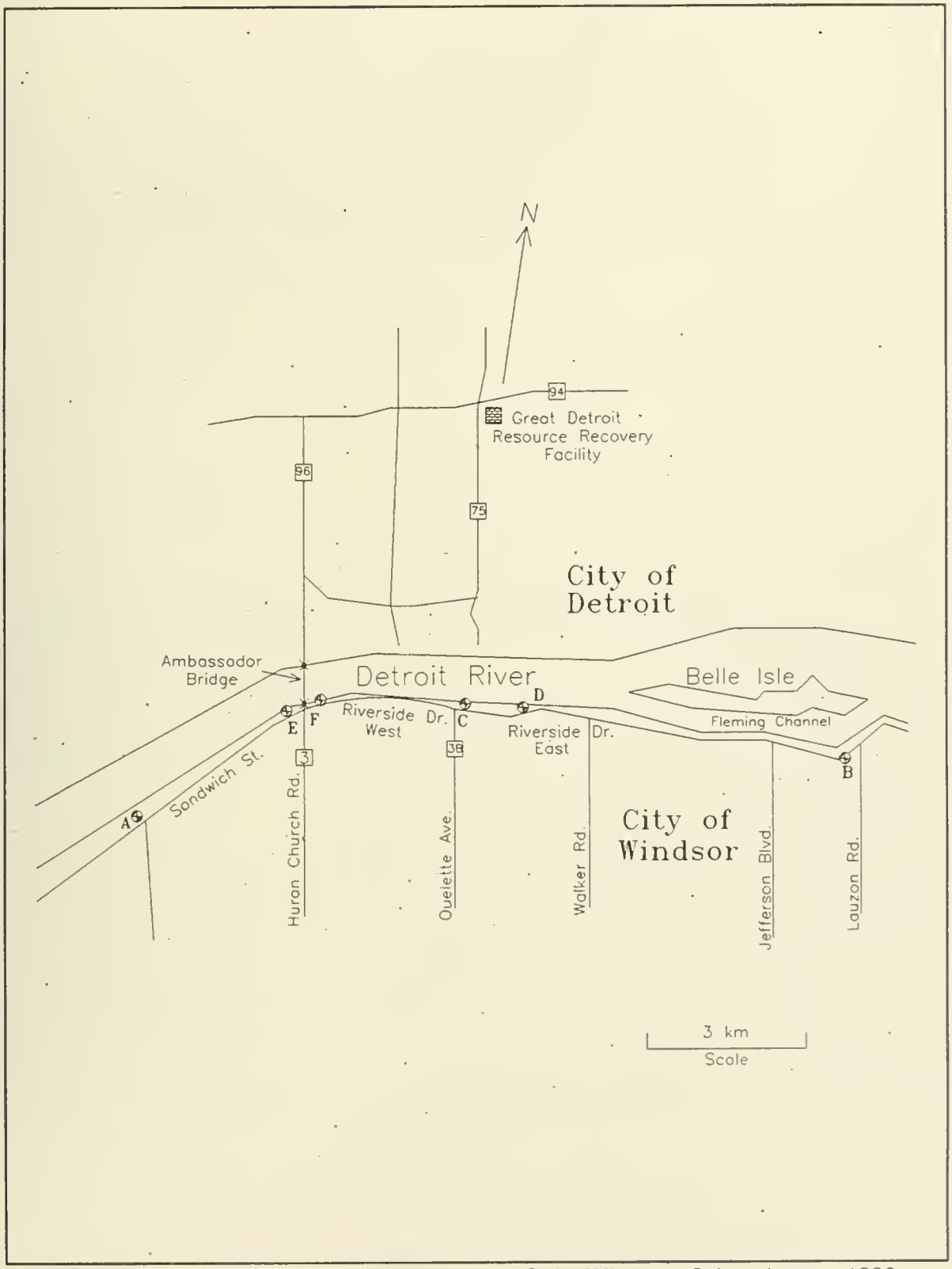

Figure 6.1.1: Downwind monitoring sites for HCl in Windsor, July - August 1990.

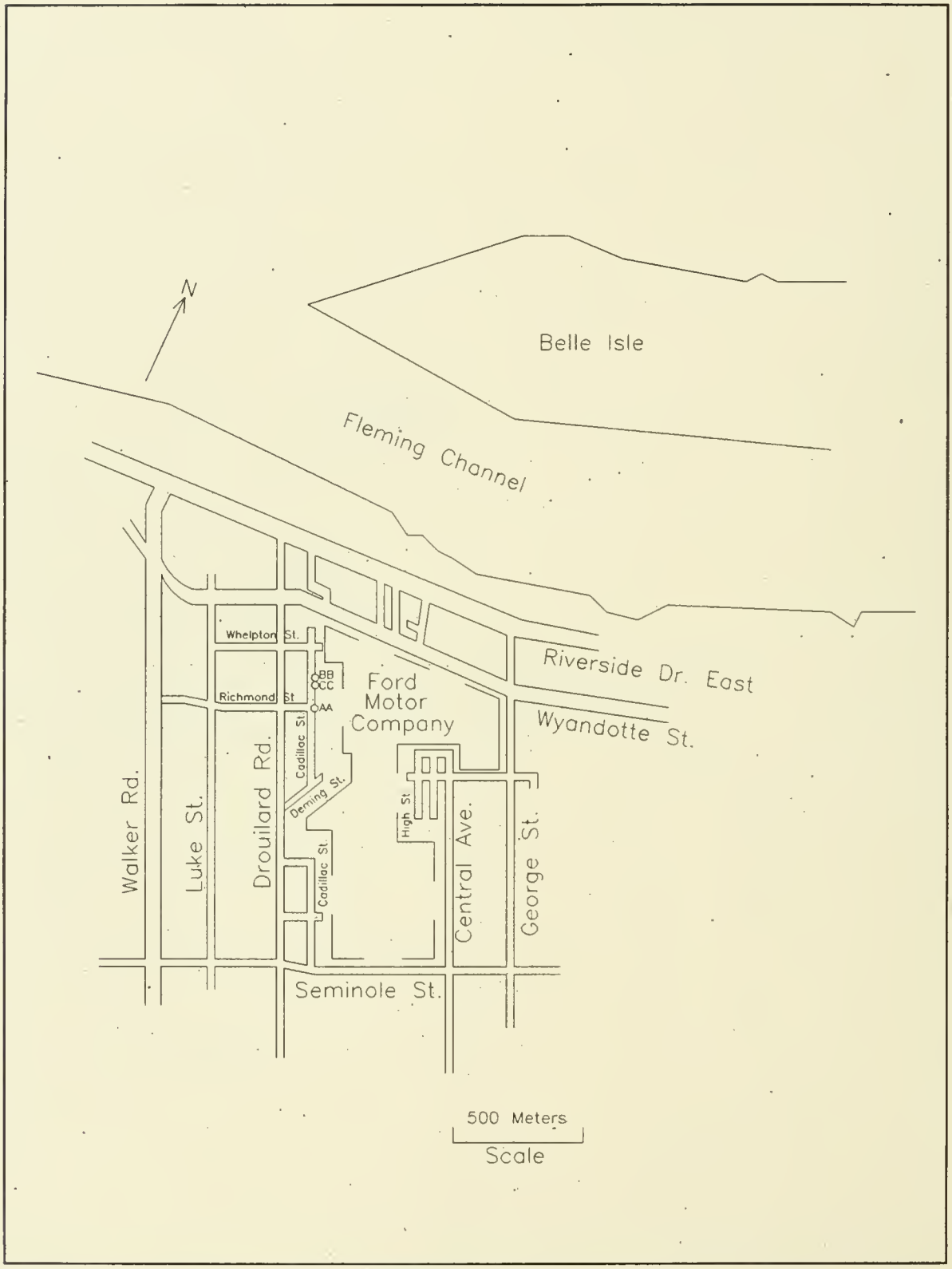

Figure 6.1.2: Monitoring sites downwind of Ford Casting Plant, July - August 1990.

Table 6.1.1: Mobile TAGA 6000 HCl Concentrations (Half-Hour Averages) Windsor (Detroit Incinerator) Survey, July - August 1990

Date	Sample Number	Start Time	Location[1]	Meteorological Conditions[2] AT	WS	WD	HCl conc.[3] ($\mu g/m^3$)	HCl DL[4] ($\mu g/m^3$)	Comments
Jul 25	S01	11:35	A	26	00-10	N	nd[5]	0.93	WD lined up with GDRRF
	S02	12:05	A	27	00-10	WSW	nd	0.93	WD not lined up
	S03	12:36	A	29	00-10	SSW	nd	0.93	WD not lined up
	S04	14:20	B	28	00-10	E	nd	0.93	WD not lined up
	S05	14:50	B	29	05-10	ENE	nd	0.93	WD not lined up
	S06	15:20	B	30	00-10	ENE	nd	0.93	WD not lined up
	S07	16:52	A	31	10-20	SSW	nd	0.93	WD not lined up
	S08	17:42	A	29	10-15	S	nd	0.93	WD not lined up
	S09	18:12	A	29	05-15	S	nd	0.93	WD not lined up
Jul 31	S10	11:14	C	23	10-20	N	nd	1.1	WD lined up with GDRRF
	S11	13:20	D	22	20-30	NE	nd	1.1	WD not lined up
	S12	13:50	D	23	20-30	NNE	nd	1.1	WD not lined up
	S13	14:59	E	22	20-30	NNE	nd	1.1	WD lined up with GDRRF
	S14	15:29	E	22	20-30	NNE	nd	1.1	WD lined up with GDRRF
	S15	16:02	E	23	20-30	NNE	nd	1.1	WD lined up with GDRRF
	S16	16:32	E	24	20-30	NNW	nd	1.1	WD occasionally lined up
	S17	17:34	E	24	20-30	N	nd	1.1	WD occasionally lined up
	S18	18:04	E	24	20-30	N	nd	1.1	WD occasionally lined up
	S19	18:56	E	23	15-25	NNW	nd	1.1	WD occasionally lined up
Aug 01	S20	10:32	F	24	10-20	NE	nd	1.3	WD occasionally lined up
	S21	11:02	F	24	15-25	NE	nd	1.3	WD occasionally lined up
	S22	11:37	F	23	15-25	NE	nd	1.3	WD occasionally lined up
	S23	12:07	F	23	20-30	NE	nd	1.3	WD occasionally lined up
	S24	12:37	F	24	15-25	NE	nd	1.3	WD occasionally lined up
	S25	13:08	F	24	15-25	NE	nd	1.3	WD occasionally lined up
	S26	13:58	F	23	25-35	NE	nd	1.3	WD occasionally lined up

Notes:

1. See Figure 6.1.1 for monitoring locations.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. Determination of half-hour average concentrations is based on daily calibrations of HCl.
4. During this survey the detection limit (DL) for HCl was 1.1 ± 0.18 $\mu g/m^3$.
5. nd=not detected, refers to concentrations lower than the limit of detection. The Ministry Standard for HCl, based on corrosion effects, is 100 $\mu g/m^3$.

Table 6.1.2: Mobile TAGA 6000 Monitoring Periods and Locations
Windsor (Ford Casting Plant) Survey, July - August 1990

Date	Fingerprint Number	Monitoring Period	Location[1]	Meteorological Conditions[2] AT	WS	WD	Comments
Jul 26	F01	12:24-16:39	AA	28-30	00-10	N	moderate odours
Jul 27	F02	11:42-12:01	BB	29	00-10	NE	strong odours
Jul 30	F03	19:00-19:59	CC	24	00-15	NNE	moderate odours

Notes:
1. See Figure 6.1.2 for monitoring locations.
2. Met. conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.

Table 6.1.3: Mobile TAGA 6000 Odour Fingerprints
Target Source: Ford Casting Plant
Windsor Survey, July - August 1990

Compounds Detected[1]	Estimated Concentrations[3] ($\mu g/m^3$) Fingerprint[2] # F01	F02	F03	Ministry Standard[7]	Odour Threshold[8]
Dimethylamine	1	3	10	n/a	160[b]
Acetone	5	nd	5	48,000 (S, O)	32,000[a]
Ethylene glycol	3	3	nd	n/a	13,000[a]
Methyl ethyl ketone	15	nd	5	31,000 (S, O)	4,800[a]
Diethylamine	7	5	40	n/a	180[b]
Propanediol	3	nd	<1	n/a	n/a
Pyridine	3	3	<1	60 (IS, O)	67[b]
Methyl furan	3	1	nd	n/a	n/a
Phenol	15	15	nd	100 (S, H)	22[b]
Aniline	nd	15	25	n/a	370[b]
Triethylamine	30	50	150	n/a	360[c]
C_2-alkyl benzenes[4]	50	nd	nd	2,300 (S, O)	800[b]
Toluidine (eg. 4-methylaniline)	10	5	10	n/a	120[b]
C_3-alkyl benzenes[5]	15	3	nd	n/a	700[b]
C_4-alkyl benzenes[6]	15	3	nd	n/a	n/a

Notes:

1. Compounds identified by TAGA MS/MS library search.
2. See Figure 6.1.2 and Table 6.1.2 for sampling locations and monitoring periods.
3. Concentrations (estimated ±3x) based on MS and MS/MS signals. nd = not detected.
4. C_2-alkyl benzenes: mixture of xylenes and ethyl benzene. Odour threshold refers to mixed xylenes.
5. C_3-alkyl benzenes: mixture of propyl benzene, trimethyl benzene and ethyl toluene.
6. C_4-alkyl benzenes: mixture of butyl benzene, tetramethyl benzene, diethyl benzene, propyl methyl benzene.
7. Summary of point of impingement standards, ambient air quality criteria (AAQCs), and approvals screening levels (ASLs). Ontario Ministry of the Environment (August 1992). In $\mu g/m^3$, (S) = Air Quality Standard; (IS) = Interim Standard; (O) = Based on Odours; (H) = Based on Health Effects; n/a = not available.
8. Minimum odour threshold values in $\mu g/m^3$.
   a. Procedure for the determination of odour impact models by the binary port odour panel method. Ontario Ministry of the Environment, Report # AMP-143 (Feb.'89), Draft # 10.
   b. Gemert van, L.J. Central Institute for Nutrition and Food Research TNO, Netenbreizer, A.H., (National Institute for Water Supply), Compilation of odour threshold values in air and water, Netherlands, 1977.
   c. Verschueren, K., Environmental Advisor and Dept. of Public Health and Tropical Hygiene, Agricultural University of Wageningen, Netherlands. Handbook of environmental data on organic chemicals, 2nd ed., Van Nostrand Reinhold Co., 1977.

Table 6.1.4: Mobile Scintrex Mercury Analyzer Hg Concentrations (Half-Hour Avg.) Windsor Survey, July - August 1990

Date	Start Time	Location[1]	Wind Direction	Half-Hour Avg.[2] Hg Conc. (µg/m³)	Detection Limit[3] (µg/m³)	Comments
July 25	11:36	A	N	0.021*[4]	0.009	Upwind of Detroit
	12:06	A	WSW	0.022*	0.009	Upwind of Detroit
	12:36	A	SSW	0.023*	0.009	Upwind of Detroit
	14:18	B	E	0.017*	0.011	Downwind of Detroit
	14:48	B	ENE	0.018*	0.011	Downwind of Detroit
	15:18	B	ENE	0.019*	0.011	Downwind of Detroit
	16:48	A	SSW	0.021*	0.011	Upwind of Detroit
	17:18	A	S	0.024*	0.011	Upwind of Detroit
	17:48	A	S	0.023*	0.011	Upwind of Detroit
	18:18	A	S	0.018*	0.011	Upwind of Detroit
	18:48	A	S	0.013	0.011	Upwind of Detroit
July 26	10:30	DD	NE	0.024	0.007	Upwind of Ford Casting Plant
	11:00	DD	NE	0.027	0.007	Upwind of Ford Casting Plant
	12:30	AA	N	0.036	0.009	Downwind of Ford Casting Plant
	13:00	AA	N	0.078	0.009	Downwind of Ford Casting Plant
	13:30	AA	N	0.066	0.009	Downwind of Ford Casting Plant
	14:00	AA	N	0.160	0.009	Downwind of Ford Casting Plant
	14:30	AA	N	0.024	0.009	Downwind of Ford Casting Plant
	15:00	AA	N	0.020	0.009	Downwind of Ford Casting Plant
	15:30	AA	N	0.033	0.009	Downwind of Ford Casting Plant
	16:00	AA	N	0.025	0.009	Downwind of Ford Casting Plant
	16:30	AA	N	0.009	0.009	Downwind of Ford Casting Plant
July 30	14:10	BB	W	0.042	0.012	Downwind of Ford Casting Plant
	14:40	BB	NW	0.040	0.012	Downwind of Ford Casting Plant
	15:10	BB	N	0.045	0.012	Downwind of Ford Casting Plant
	15:40	BB	N	0.046	0.012	Downwind of Ford Casting Plant
	16:10	BB	NE	0.035	0.012	Downwind of Ford Casting Plant
	16:40	BB	NE	0.030	0.012	Downwind of Ford Casting Plant
	17:10	BB	NE	0.029	0.012	Downwind of Ford Casting Plant
	17:40	BB	NE	0.022	0.012	Downwind of Ford Casting Plant
	18:10	BB	NE	0.026	0.012	Downwind of Ford Casting Plant
	18:40	BB	NNE	0.026	0.012	Downwind of Ford Casting Plant
	19:10	BB	NNE	0.047	0.012	Downwind of Ford Casting Plant
	19:40	BB	NNE	0.031	0.012	Downwind of Ford Casting Plant
	20:10	BB	NNE	0.022	0.012	Downwind of Ford Casting Plant
July 31	09:47	D	N	0.012	0.009	Downwind of Ford Casting Plant
	10:17	D	N	0.012	0.009	Downwind of Ford Casting Plant
	10:47	D	N	0.014	0.009	Downwind of Ford Casting Plant
	11:17	D	N	0.015*	0.009	Downwind of Ford Casting Plant
	11:47	D	NW	0.016	0.009	Downwind of Ford Casting Plant
	12:17	D	N	0.017	0.009	Downwind of Ford Casting Plant
	12:47	D	N	0.020	0.009	Downwind of Ford Casting Plant
	13:17	D	NE	0.029*	0.009	Downwind of Ford CAsting Plant
	13:47	D	NNE	0.023*	0.009	Downwind of Ford Casting Plant
	14:17	D	NNE	0.024	0.009	Downwind of Ford Casting Plant
	14:47	D	NNE	0.024	0.009	Downwind of Ford Casting Plant
	15:17	D	NNE	0.022	0.009	Downwind of Ford Casting Plant
	15:47	D	NNE	0.021	0.009	Downwind of Ford Casting Plant
	16:17	D	NNE	0.020	0.009	Downwind of Ford Casting Plant
	16:47	D	NNW	0.020	0.009	Downwind of Ford Casting Plant

Table 6.1.4: Mobile Scintrex Mercury Analyzer Hg Concentrations (Half-Hour Avg.) Windsor Survey, July - August 1990

...continued...

Date	Start Time	Location[1]	Wind Direction	Half-Hour Avg.[2] Hg Conc. ($\mu g/m^3$)	Detection Limit[3] ($\mu g/m^3$)	Comments
Aug 1	09:18	F	NE	0.015	0.009	Downwind of Detroit
	09:48	F	NE	0.014	0.009	Downwind of Detroit
	10:18	F	NE	0.020	0.009	Downwind of Detroit
	10:48	F	NE	0.020	0.009	Downwind of Detroit
	11:18	F	NE	0.019	0.009	Downwind of Detroit
	11:48	F	NE	0.019	0.009	Downwind of Detroit
	12:18	F	NE	0.020	0.009	Downwind of Detroit
	12:48	F	NE	0.017	0.009	Downwind of Detroit
	13:18	F	NE	nd[3]	0.009	Downwind of Detroit
	13:48	F	NE	0.010	0.009	Downwind of Detroit
	14:18	F	NE	0.014	0.009	Downwind of Detroit
	15:32	CC	E	0.019	0.009	Downwind of Ford Casting Plant
	16:02	CC	NE	0.020	0.009	Downwind of Ford Casting Plant
	16:32	CC	E	0.018	0.009	Downwind of Ford Casting Plant
	17:02	CC	E	0.035	0.009	Downwind of Ford Casting Plant
	17:32	CC	NE	0.044	0.009	Downwind of Ford Casting Plant
	18:02	CC	NE	0.022	0.009	Downwind of Ford Casting plant
	18:32	CC	NE	0.024	0.009	Downwind of Ford Casting Plant
Aug 2	09:43	B	E	0.029	0.009	Downwind of Detroit
	10:13	B	S	0.015	0.009	Downwind of Detroit
	10:43	B	SE	0.024	0.009	Downwind of Detroit
	11:13	B	W	0.024	0.009	Downwind of Detroit
	11:43	B	SW	0.027	0.009	Downwind of Detroit
	12:13	B	SW	0.030	0.009	Downwind of Detroit
	12:43	B	SW	0.033	0.009	Downwind of Detroit
	13:13	B	SW	0.037	0.009	Downwind of Detroit
	13:43	B	SW	0.039	0.009	Downwind of Detroit
	14:13	B	SW	0.035	0.009	Downwind of Detroit
	14:43	B	SW	0.042	0.009	Downwind of Detroit
	15:13	CC	SW	0.076	0.009	Downwind of Ford Casting Plant
	15:43	CC	SW	0.035	0.009	Downwind of Ford Casting Plant
	16:13	CC	SW	0.041	0.009	Downwind of Ford Casting Plant
	16:43	CC	SW	0.058	0.009	Downwind of Ford Casting Plant
	17:13	CC	SW	0.055	0.009	Downwind of Ford Casting Plant
	17:43	CC	SW	0.047	0.009	Downwind of Ford Casting Plant

Notes:
1. See Figures 6.1.1 and 6.1.2 for monitoring locations, except for site DD, Wyandott and George St., upwind of Ford Casting Plant.
2. Determination of half-hour average concentrations is based on daily calibrations of Hg.
3. nd = not detected, refers to concentrations lower than the limits of detection; the Ministry Standard for Hg, based on health effects, is 5 $\mu g/m^3$; average daily detection limit is 0.01 $\mu g/m^3 \pm 0.001$.
4. * = simultaneous measurement with HCl, within 6 minutes.

6.2 Appendix B: Monitoring Results and Relevant Information of the Ford Essex Aluminum Plant 1991 Survey

Figure 6.2.1 shows the monitoring sites downwind of Ford Essex Aluminum Plant. The relevant information and the odour fingerprints are reported in Table 6.2.1. Half-hour average concentrations of chlorine and styrene recorded during this survey are summarized in Table 6.2.2.

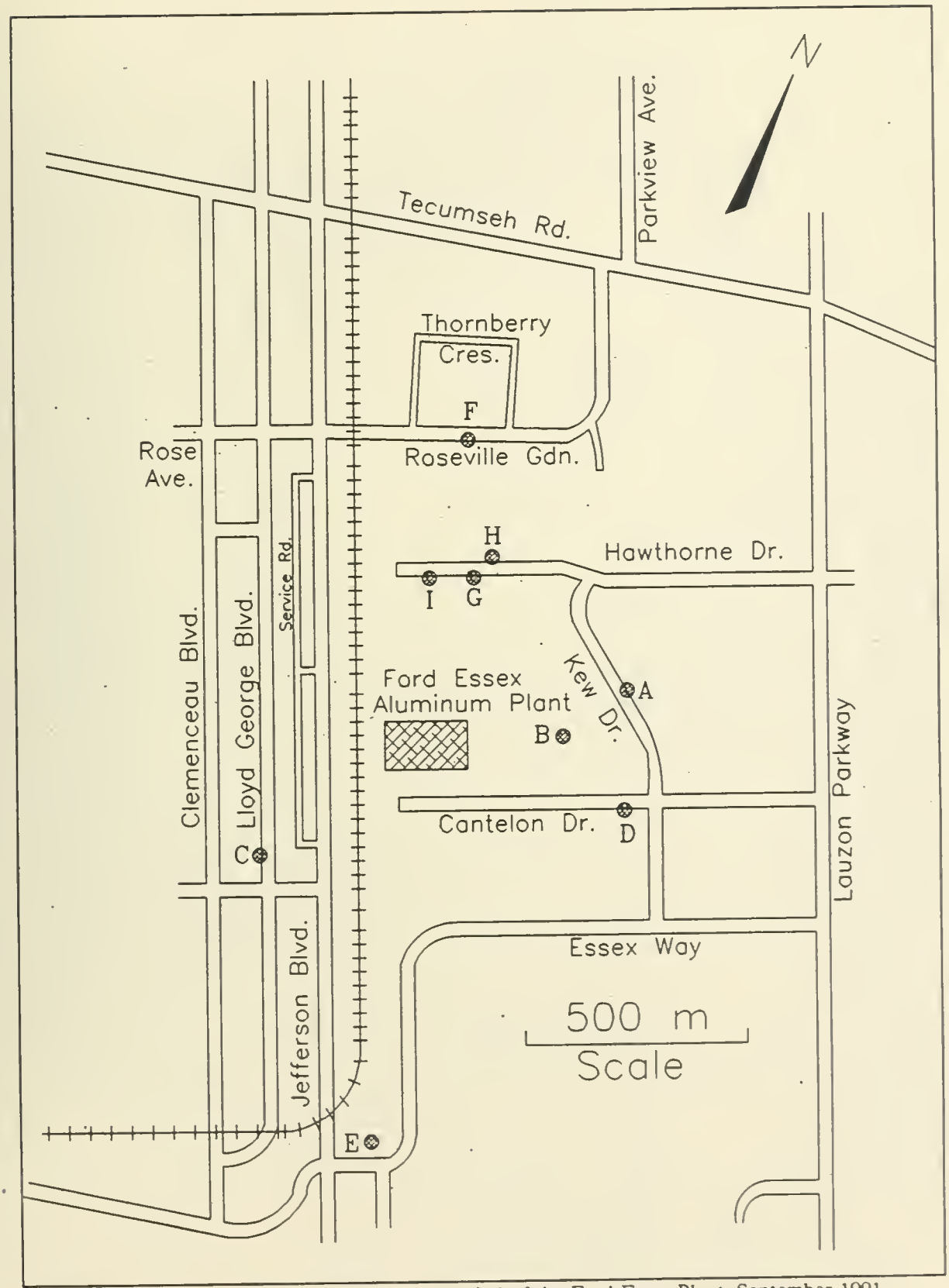

Figure 6.2.1: TAGA 6000 monitoring sites downwind of the Ford Essex Plant, September 1991.

Table 6.2.1: Mobile TAGA 6000 Odour Fingerprints
Windsor (Ford Essex Aluminum Plant) Survey, September 1991

Compound[1] Detected	Date	Start Time	Site[2]	Meteorology[3] AT	WS	WD	Est.Conc.[4] ($\mu g/m^3$)	Ministry[5] Standard	Odour[6] Threshold	Comments
Hydrogen fluoride	Sep.03	18:38	B	27	20-25	SW	30	4.3 (IS,V)	30[a]	Odours present
Hydrogen chloride	Sep.03	18:46	B	27	15-20	SW	50	100 (S,C)	380[a]	Odours present
Chlorine	Sep.03	20:29	B	23	20-40	SW	3	300 (S,H&V)	60[a]	Heavy rain
Styrene	Sep.03	16:55	A	29	20-30	SW	20	400 (S,O)	220[a]	Odours present
Butyl carbitol	Sep.03	19:55	B	26	05-10	SW	10	n/a	n/a	
Phenol	Sep.05	16:47	I	23	15-20	S	2	100 (S,H)	22[a]	Odours present
Triethylamine	Sep.05	17:03	I	23	10-15	SSW	1	n/a	360[b]	

Notes:
1. Compounds identified by TAGA MS/MS library search.
2. See Figure 6.2.1 for monitoring sites.
3. Met. conditions at 10 meters: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
4. Concentrations (estimated ±3x) based on MS and MS/MS signals.
5. Summary of point of impingement standards, ambient air quality criteria (AAQCs), and approvals screening levels (ASLs). Ontario Ministry of the Environment (Aug.91).
   In $\mu g/m^3$: (S) = Air Quality Standard; (IS) = Interim Standard; (V) = Based on Vegetation; (C) = Based on Corrosion; (H) = Based on Health Effects; (O) = Based on Odour; n/a = not available.
6. Minimum odour threshold values in $\mu g/m^3$.
   a. Gemert van, L.J. Central Institute for Nutrition and Food Research TNO, Netenbreizer, A.H., (National Institute for Water Supply), Compilation of odour threshold values in air and water, Netherlands, 1977.
   b. Verschueren, K., Environmental Advisor and Dept. of Public Health and Tropical Hygiene, Agricultural University of Wageningen, Netherlands. Handbook of environmental data on organic chemicals, 2nd ed., Van Nostrand Reinhold Co., 1977.

Table 6.2.2: Half-Hour Average Concentrations (TWA) of Styrene and Chlorine Windsor (Ford Essex Aluminum Plant) Survey, September 1991

Date	Sample Number	Start Time	Site[1]	Metcorology[2] AT	WS	WD	Concentration (µg/m³)[3] Styrene (St) TWA	DL	SHR	Chlorine (Cl) TWA	DL	SHR	Comments
Sep.03	St-01	15:45	Ref.[4]	29	05-20	SW	<4.5	4.5	-				
	St-02	16:57	A	28	10-30	SW	<4.5	4.5	20				Intermittent styrene odours present
	St-03	17:34	A	28	10-25	SW	<4.5	4.5	10				Intermittent styrene odours present
	Cl-01	14:57	Ref.	28	10-20	SW				0.53	0.44	-	
	Cl-02	20:07	B	24	20-40	SSW				0.55	0.44	2.7	Thunderstorm began
Sep.04	St-04	10:03	Ref.	22	00-15	N	<4.3	4.3	-				
	St-05	13:36	C	24	00-20	NE	<4.3	4.3	-				Winds varied between NW and NE
	St-06	15:18	C	25	00-20	N	<4.3	4.3	-				Winds varied between NW and NE
	St-07	16:36	D	28	00-20	N	<4.3	4.3	-				Winds varied between NW and NE
	St-08	18:05	E	25	00-10	NNE	<4.3	4.3	-				Winds varied between N and NE
	Cl-03	10:40	Ref.	23	00-10	N				<0.31	0.31	-	
	Cl-04	14:13	C	25	00-20	NE				<0.31	0.31	-	Winds varied between NW and NE
	Cl-05	14:45	C	25	00-15	N				0.31	0.31	0.78	Winds varied between NW and NE
	Cl-06	17:32	E	26	05-15	N				<0.31	0.31	-	Winds varied between NW and NE
Sep.05	St-09	12:33	Ref.	25	00-10	NE	<0.78	0.78	-				
	St-10	13:47	Ref.	24	00-10	NE	<0.78	0.78	-				
	St-11	15:48	F	23	00-20	SE	<0.78	0.78	16				Intermittent styrene odours present
	St-12	17:16	G	24	00-10	S	<0.78	0.78	6.9				Winds varied between SW abd SE
	St-13	18:54	H	23	10-20	S	<0.78	0.78	11				Intermittent styrene odours present
	St-14	19:26	H	22	05-15	SSW	<0.78	0.78	-				Intermittent phenolic odours present
	St-15	20:28	H	20	00-05	S	<0.78	0.78	1.9				Winds became light
	Cl-07	13:06	Ref.	25	00-10	NE				<0.28	0.28	-	
	Cl-08	17:48	G	25	00-15	SSE				<0.28	0.28	-	

Notes:
1. See Figure 6.2.1 for monitoring sites.
2. AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction.
3. TWA=time weighted average - half-hour average (means of 361 instantaneous readings); SHR=single highest instantaneous reading during TWA; DL=detection limit; "-" means SHR less than DL.
4. Ref.=reference site, parking lot on the SE corner of Chatham Street W. and Janette Avenue.

6.3 Appendix C: Monitoring Results and Relevant Information of the Ford Essex Aluminum Plant 1992 Survey

Figure 6.3.1 shows the monitoring sites downwind of Ford Essex Aluminum Plant. The relevant information and the odour fingerprints are reported in Table 6.3.1. Half-hour average concentrations of hydrogen fluoride and hydrogen chloride recorded during this survey are summarized in Table 6.3.2. Figure 6.3.2 is an example of real-time HF data collected by the TAGA over a half-hour period. TAGA half-hour average concentrations of HF collected during this survey are plotted in Figure 6.3.3. Similarly, TAGA half-hour concentrations of HCl are plotted in Figure 6.3.4. A TAGA HF profile by plume tracking via street criss-crossing in the vicinity west of Ford Essex is shown in Figure 6.3.5. The corresponding map is shown in Figure 6.3.6.

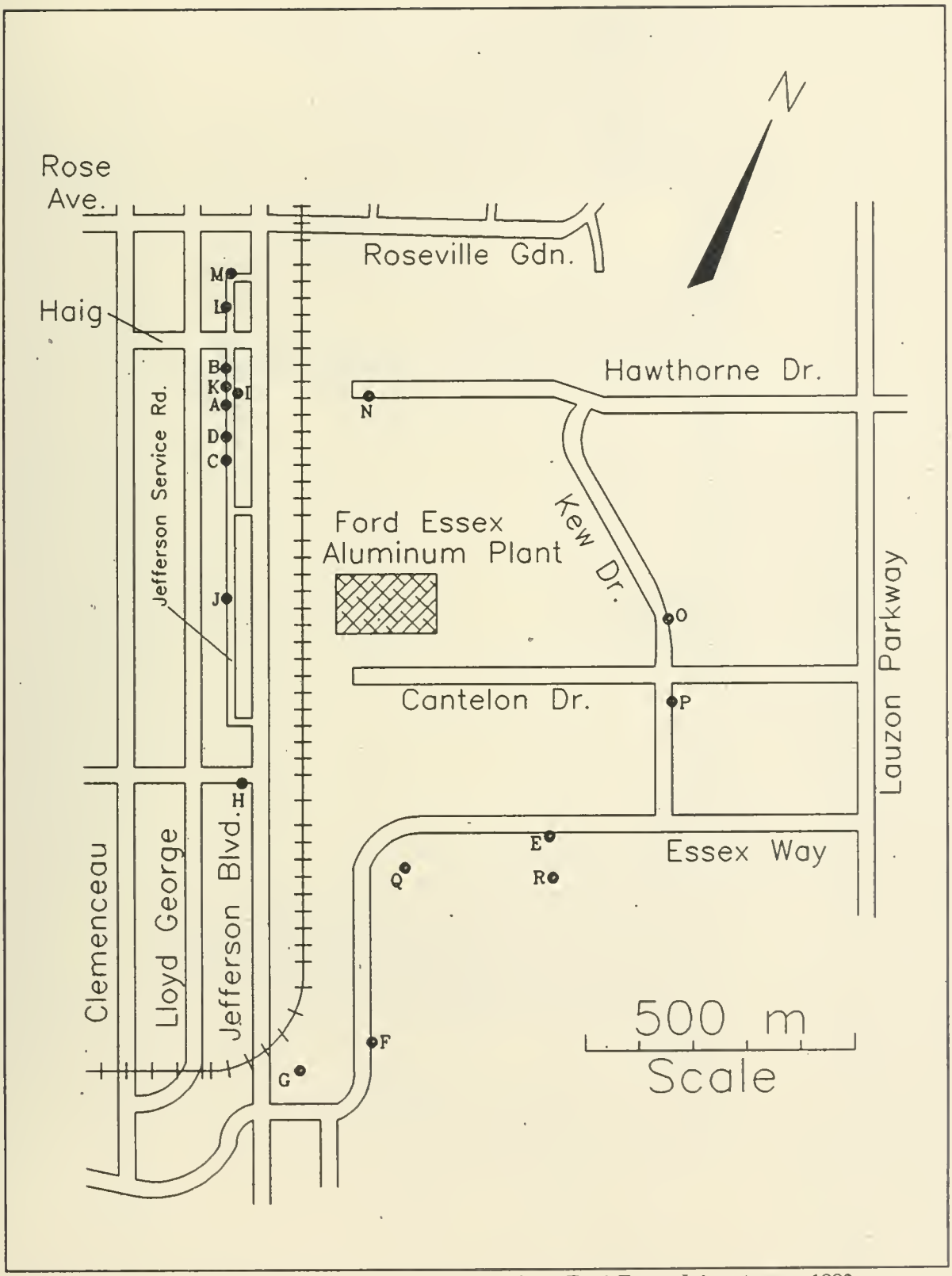

Figure 6.3.1: TAGA 6000 monitoring sites downwind of the Ford Essex, July - August 1992.

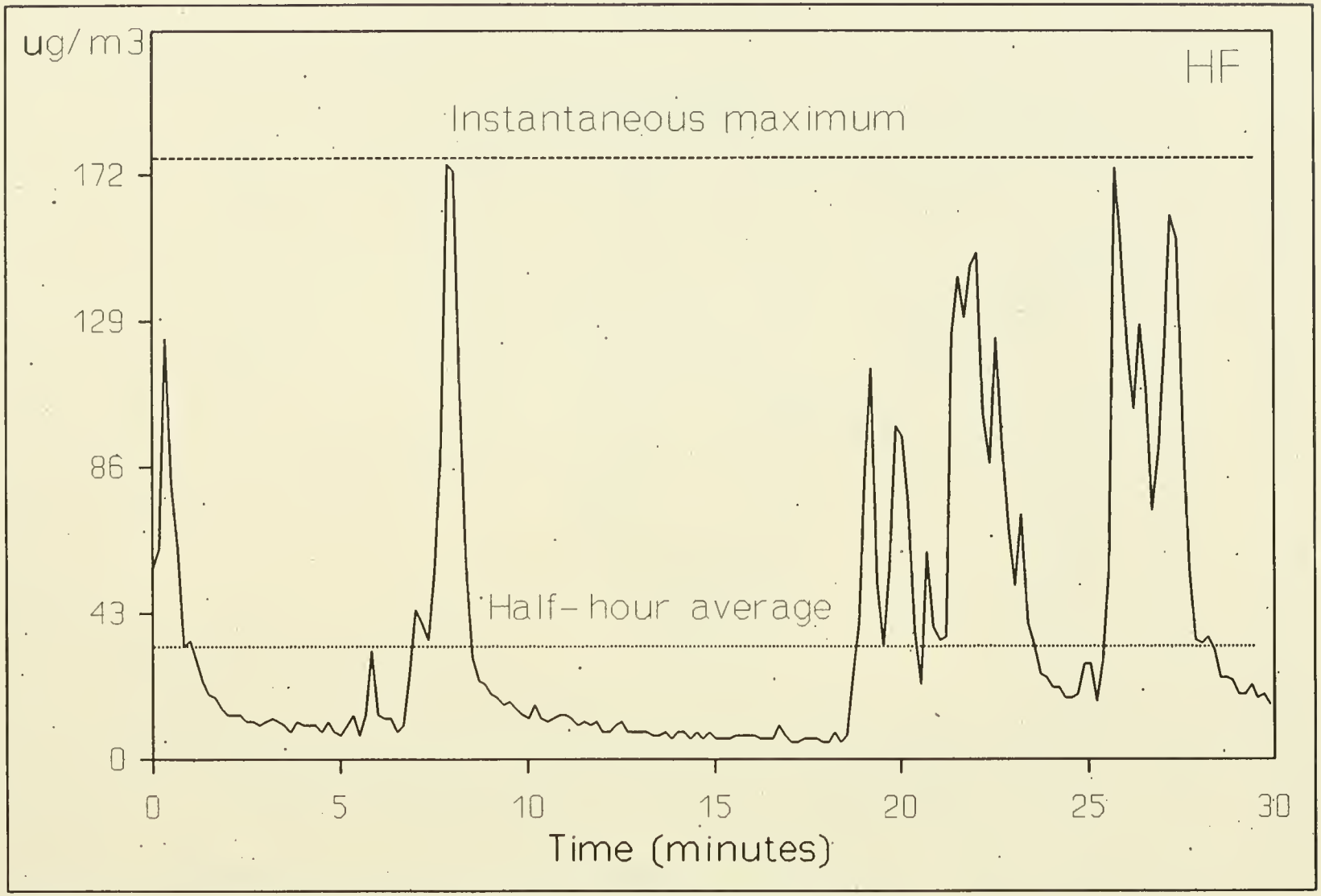

Figure 6.3.2: TAGA real-time data for HF (S46, Table 6.3.2). Ford Essex, July - August 1992.

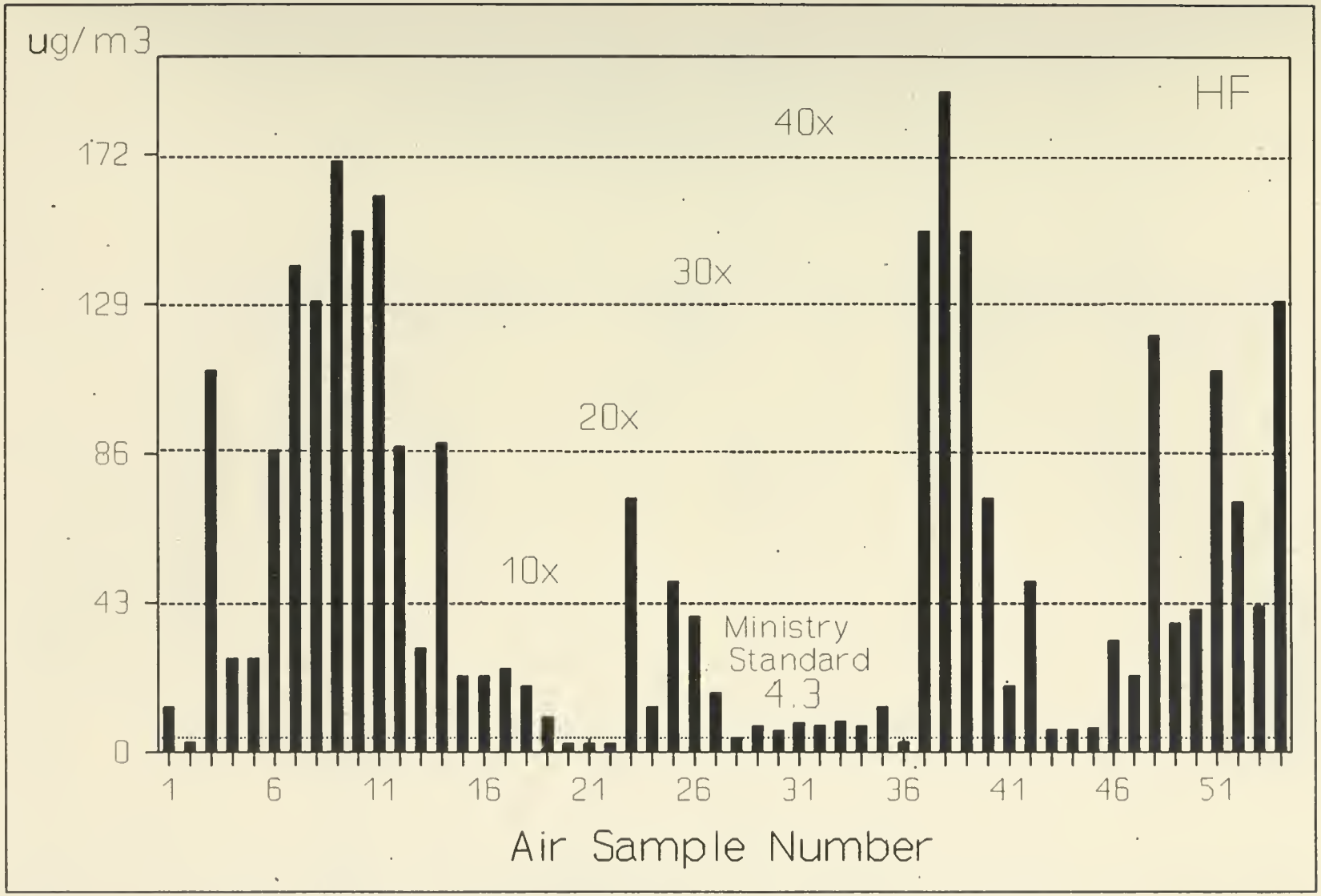

Figure 6.3.3: TAGA half-hour average concentrations of HF (see Table 6.3.2). Ford Essex, July - August 1992.

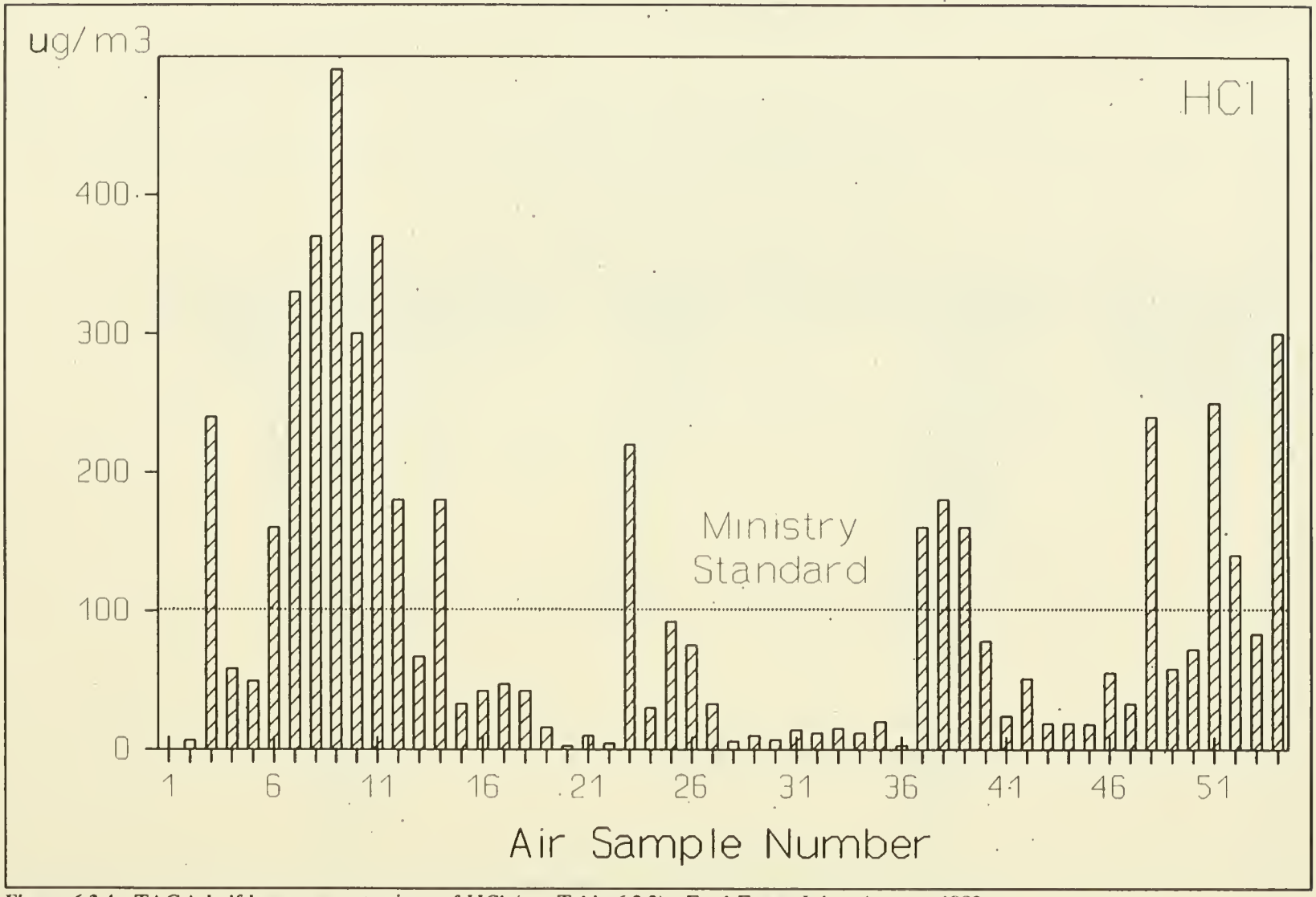

Figure 6.3.4: TAGA half-hour concentrations of HCl (see Table 6.3.2). Ford Essex, July - August 1992.

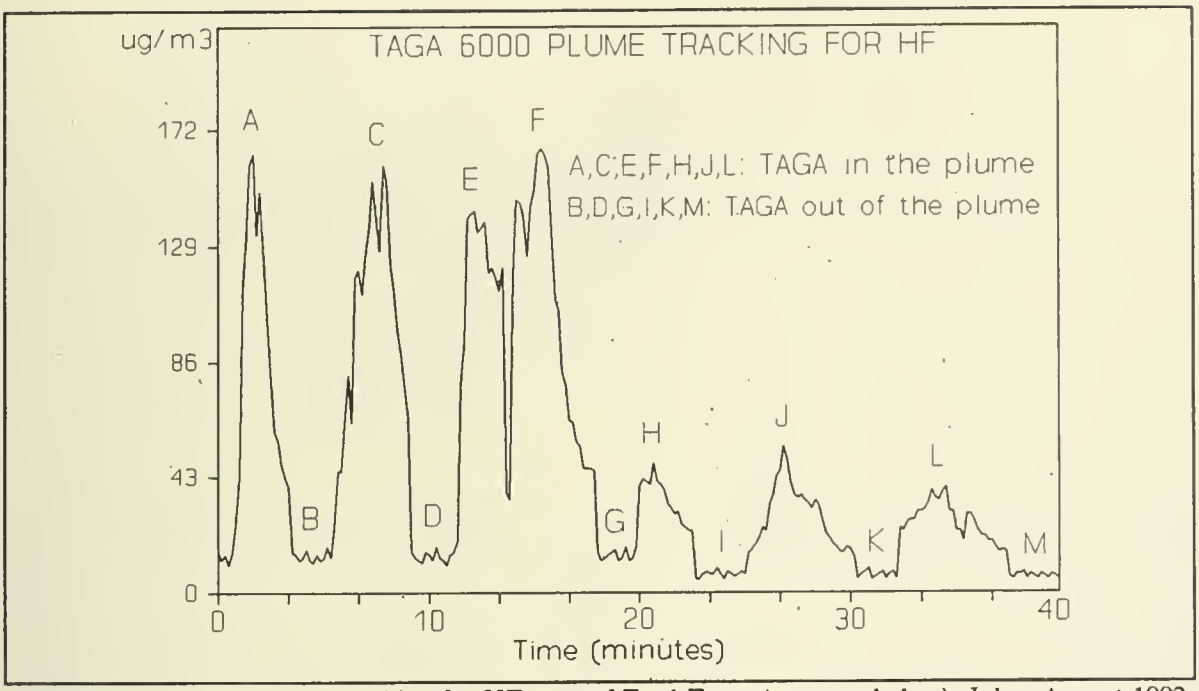

Figure 6.3.5: TAGA plume tracking for HF west of Ford Essex (see map below), July - August 1992.

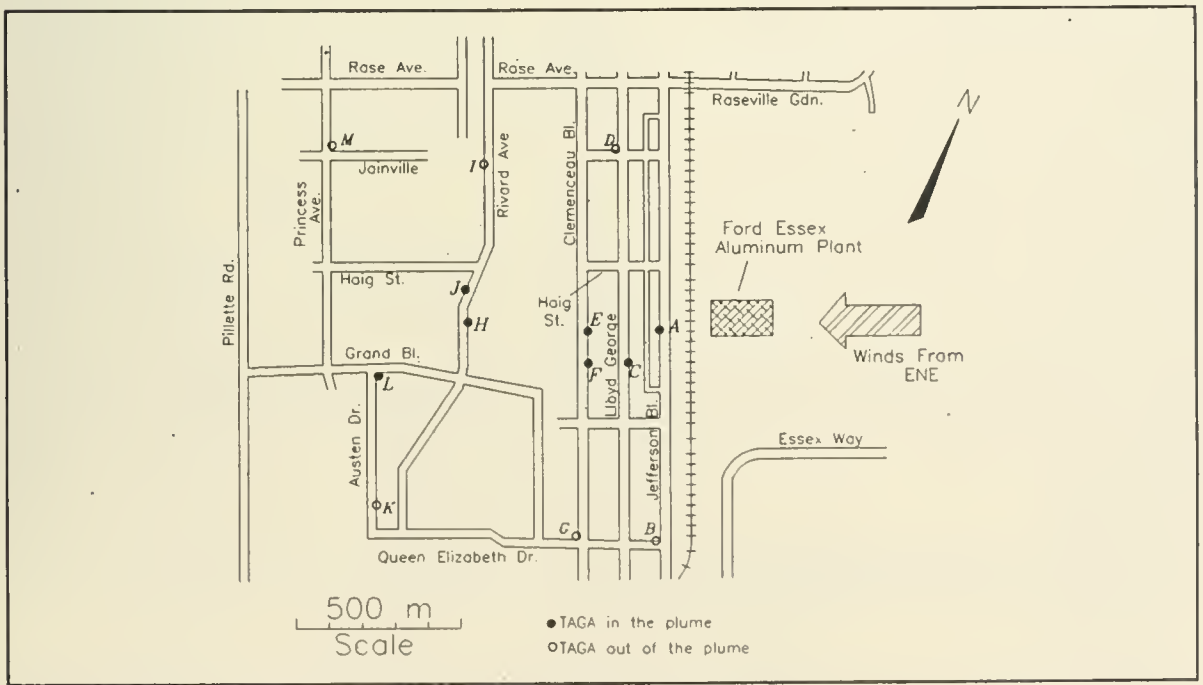

Figure 6.3.6: TAGA plume tracking via street criss-crossing; started at A, ended at M (see profile above).

Table 6.3.1: Monitoring Periods and Locations of Odour Fingerprints Downwind of Ford Essex, Windsor Mobile TAGA 6000 Survey, July - August 1992

Date	Fingerprint Number	Monitoring Period	Site[1]	Meteorology[2] AT	WS	WD	Compounds Identified[3]
July 30	F01	13:00-13:15	A	19	15-25	E	HF, HCl
	F02	15:46-16:01	C	17	20-30	ENE	HF, HCl
August 4	F03	17:06-17:38	E	24	30-45	NW	styrene, phenol, aniline, triethylamine
	F04	18:07-18:16	F	22	25-40	N	HF, HCl
August 10	F05	19:32-19:40	O	30	20-35	W	HF, HCl
	F06	20:40-40:46	P	29	15-30	W	HF, HCl
August 11	F07	16:03-16:51	R	27	15-25	NW	HF, HCl, aniline, triethylamine

Compound	Estimated Conc. Range[4]	Ministry Standard[5]	Minimum Odour Threshold[6]	Odour Description
Hydrogen fluoride (HF) :	3 - 40	4.3	30	strong, irritating
Hydrogen chloride (HCl):	1 - 25	100	380	irritating, pungent
Styrene (C_8H_8) :	5 - 20	400	220	solvently, rubbery

Notes: 1. See Figure 6.3.1 for monitoring sites. 2. Meteorological conditions at 10 metres: AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction (wind from). 3. Identified by TAGA MS/MS library search during chemical fingerprints recorded downwind of Ford Essex. Intermittent, mild to strong odours noted during fingerprinting. 4. Estimated (±3x) concentrations in $\mu g/m^3$ based on MS and MS/MS signals. 5. Standards for a half-hour average in $\mu g/m^3$. 6. Minimum odour threshold values in $\mu g/m^3$ from various references.

Table 6.3.2: Half-Hour Average Concentrations of HF and HCl Downwind of Ford Essex, Windsor
Mobile TAGA 6000 Survey, July - August 1992

Date	Sample Number	Start Time	Site[1]	Meteorology[2] AT	WS	WD	Conc. (µg/m³) HF[3]	HCl[4]	Odour Comments
July 30	S01	13:14	A	19	15-25	ESE	13	-[5]	rubbery, styrene-like
	S02	14:07	B	17	15-25	E	det[5]	6.5	present for 5 minutes
	S03	14:44	C	18	15-25	E	110	240	strong, persistent
	S04	15:14	C	18	20-30	ENE	27	58	moderate, intermittent
	S05	16:03	C	17	20-30	ENE	27	49	moderate, intermittent
	S06	16:33	C	17	20-35	ENE	87	160	strong, persistent
	S07	17:04	C	17	20-35	E	140	330	very strong, continuous
	S08	17:34	C	17	20-35	E	130	370	very strong, continuous
	S09	18:04	C	17	20-35	E	170	490	very strong, continuous
	S10	18:34	C	17	20-35	E	150	300	very strong, continuous
	S11	21:36	D	17	20-30	E	160	370	very strong, steady
	S12	22:07	D	18	20-30	ENE	88	180	strong, occasional
August 04	S13	15:33	E	25	30-50	NW	30	67	moderate, intermittent
	S14	16:03	E	25	30-50	NW	89	180	strong, intermittent
	S15	16:34	E	24	30-45	NW	22	33	mild, occasional
	S16	18:16	F	22	25-40	N	22	42	mild, occasional
	S17	18:46	F	22	25-40	N	24	47	mild, occasional
	S18	19:16	F	22	25-40	N	19	42	mild, occasional
	S19	20:08	G	21	10-20	NNE	10	16	present for 3 minutes
August 05	S20	13:04	H	25	05-15	ENE	nd[5]	nd	not present
	S21	13:55	I	27	00-15	E	nd	det	not present
	S22	15:05	J	28	05-20	ESE	nd	det	not present
	S23	15:57	K	27	10-20	SE	73	220	strong, steady
	S24	16:28	K	26	05-15	SSE	13	30	present for 3 minutes
	S25	17:03	K	26	10-20	SE	49	92	moderate, intermittent
	S26	17:33	K	26	10-20	SE	39	75	present for 5 minutes
	S27	18:03	K	25	10-20	SE	17	33	present for 5 minutes
	S28	18:33	K	25	05-15	SSE	det	det	not present

Notes:
1. See Figure 6.3.1 for downwind monitoring sites.
2. AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction (wind from).
3. TWA=time weighted average: background corrected half-hour average (mean of 361 instantaneous readings) of HF downwind of Ford Essex.
4. TWA=time weighted average: background corrected half-hour average (mean of 361 instantaneous readings) of HCl downwind of Ford Essex.
5. nd = not detected (less than TAGA's detection limit, DL); det = detected (between DL and QL=3.3xDL). - = not available.

Table 6.3.2: Half-Hour Average Concentrations of HF and HCl Downwind of Ford Essex, Windsor Mobile TAGA 6000 Survey, July - August 1992

...continued...

Date	Sample Number	Start Time	Site[1]	Meteorology[2] AT	WS	WD	Conc. (µg/m³) HF[3]	HCl[4]	Odour Comments
August 06	S29	11:48	L	25	05-20	SSE	**7.5**	**det**[5]	present for 3 minutes
	S30	12:33	M	26	10-25	SSE	**6.3**	**det**	very mild, occasional
	S31	13:04	M	26	10-25	SSE	**8.5**	**14**	present for 5 minutes
	S32	13:35	M	27	05-20	SE	**7.7**	**12**	present for 5 minutes
	S33	14:05	M	27	10-25	SSE	**8.9**	**15**	present for 5 minutes
	S34	14:59	N	28	15-30	SE	**7.5**	**12**	present for 5 minutes
	S35	15:37	N	27	15-30	SE	**13**	**20**	very mild, occasional
	S36	18:08	N	28	15-30	SE	**det**	**nd**[5]	present for 2 minutes
August 10	S37	17:25	O	33	20-35	WSW	**150**	**160**	strong, intermittent
	S38	17:55	O	33	25-35	WSW	**190**	**180**	strong, intermittent
	S39	18:25	O	32	20-35	WSW	**150**	**160**	strong, intermittent
	S40	18:55	O	32	25-40	W	**73**	**78**	moderate, intermittent
	S41	19:41	O	30	20-35	W	**19**	**24**	rubbery, styrene-like
	S42	20:47	P	29	15-30	W	**49**	**51**	moderate, intermittent
August 11	S43	12:22	Q	25	10-25	NNW	**6.5**	**19**	mild, intermittent
	S44	13:06	R	26	10-25	NW	**6.6**	**19**	mild, intermittent
	S45	13:36	R	26	15-30	NNW	**7.0**	**18**	mild, intermittent
	S46	14:30	R	25	15-30	NNW	**32**	**55**	moderate, intermittent
	S47	15:02	R	26	15-35	NNW	**22**	**33**	mild, intermittent
	S48	15:32	R	25	20-30	NW	**120**	**240**	strong, most time
	S49	16:52	R	27	15-25	NW	**37**	**58**	moderate, intermittent
	S50	17:24	R	27	10-30	NW	**41**	**72**	moderate, intermittent
	S51	17:54	R	25	15-25	NW	**110**	**250**	strong, steady
	S52	18:24	R	25	10-30	NW	**72**	**140**	strong, intermittent
	S53	18:54	R	25	20-35	WNW	**42**	**83**	moderate, intermittent
	S54	19:26	R	25	25-35	NW	**130**	**300**	strong, intermittent

Notes:
1. See Figure 6.3.1 for downwind monitoring sites.
2. AT=ambient temperature (°C); WS=range of wind speeds (km/hr); WD=predominant wind direction (wind from).
3. Background corrected half-hour average concentration (mean of 361 instantaneous readings) of HF downwind of Ford Essex.
4. Background corrected half-hour average concentration (mean of 361 instantaneous readings) of HCl downwind of Ford Essex.
5. nd = not detected (less than TAGA's detection limit, DL); det = detected (between DL and QL=3.3xDL). - = not available.